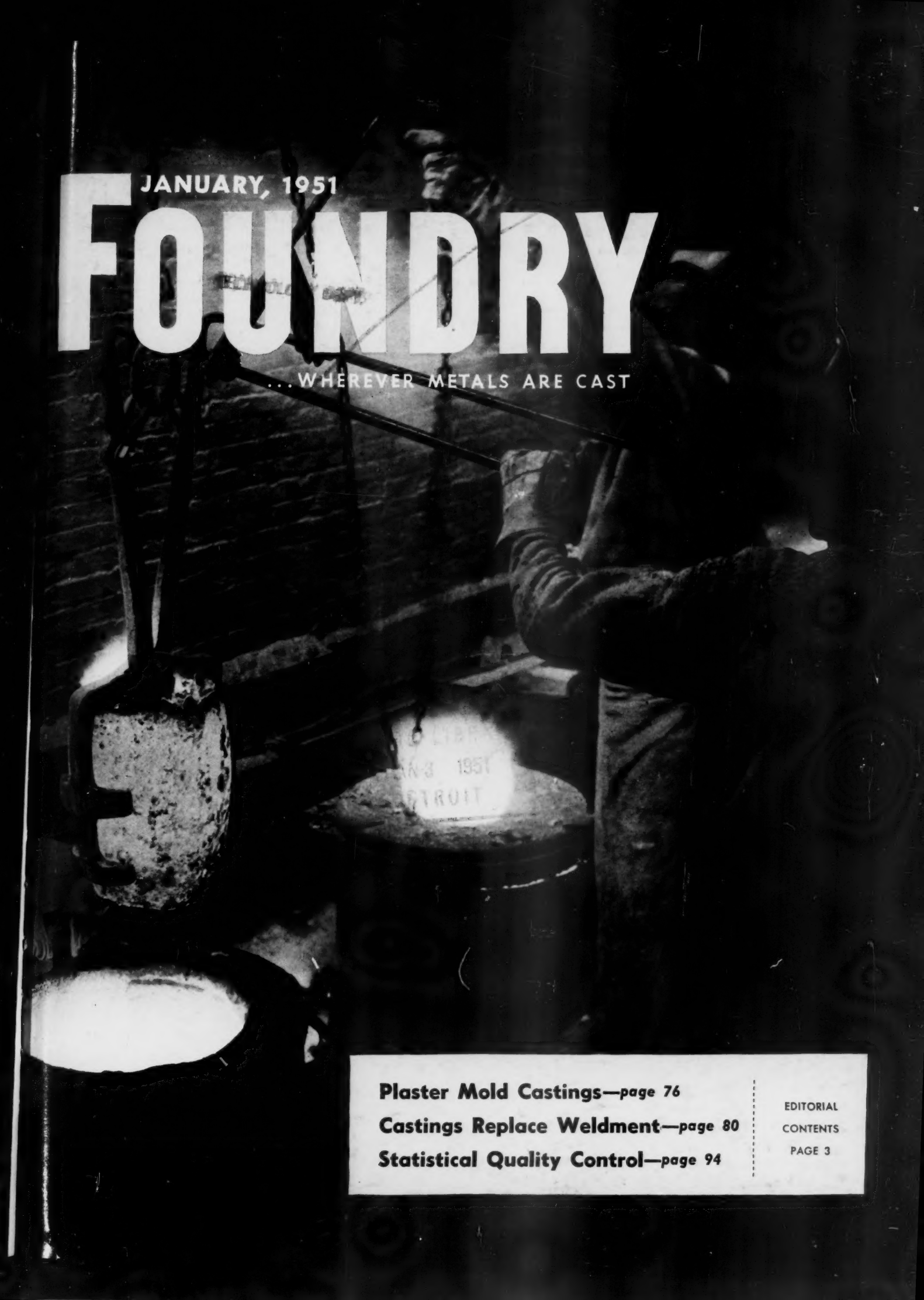

JANUARY, 1951

FOUNDRY

...WHEREVER METALS ARE CAST

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R v.29 Jan - June 1951

get CLEANER... SOUNDER... BETTER IRON CASTINGS with PURITE

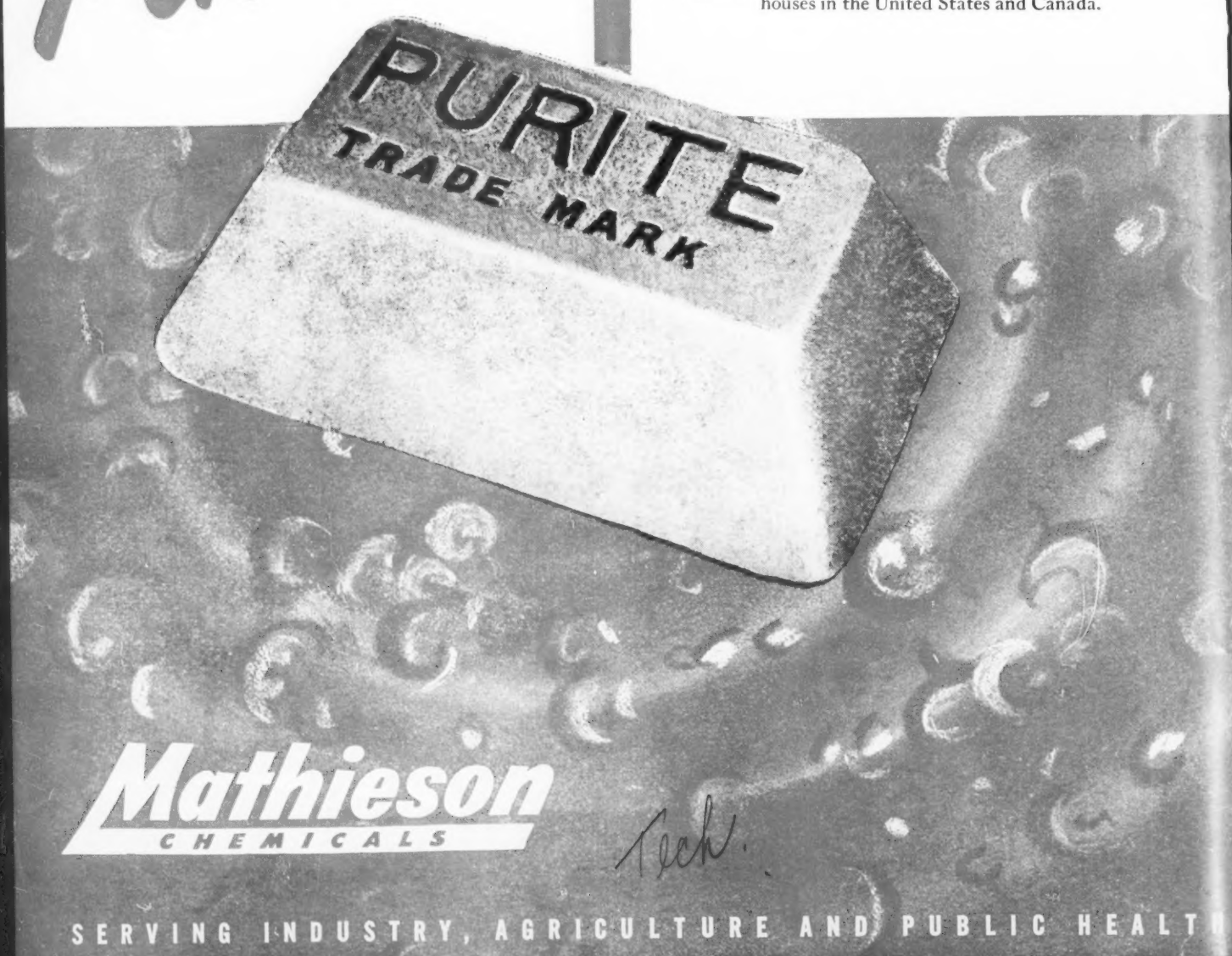
Progressive foundries throughout the country have standardized on Purite as their desulphurizer and cupola flux for improved iron castings. And their reasons for this practice are seven-fold

1. **Purite gives 100% fluxing action in the cupola — 100% desulphurizing action in the ladle.**
2. **Purite gets to the iron faster — no quicker desulphurizer made.**
3. **Purite is time-tested and proven for unsurpassed desulphurizing uniformity.**
4. **Purite comes in 2-lb. pigs — no weighing or measuring required.**
5. **Purite is 100% pure fused soda ash — you do not pay for inert materials.**
6. **Purite does not crumble — no waste — no dust.**
7. **Purite can be shipped in bulk carloads at substantial savings over bag shipments — is easily stored without deterioration.**

These benefits prove why Purite enjoys such widespread acceptance among iron foundries as the foremost cupola flux and desulphurizing agent. Write today for full information on how the quality of your iron castings can be improved with Purite. Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Md.

PURITE 100% fused soda ash. The Scientific Flux for Better Melting and Cleaner Iron.

PURITE is sold by all leading foundry supply houses in the United States and Canada.



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Tech.

TECHNOLOGY DEPT.

How Bronzes Containing NICKEL Provide Improved Properties

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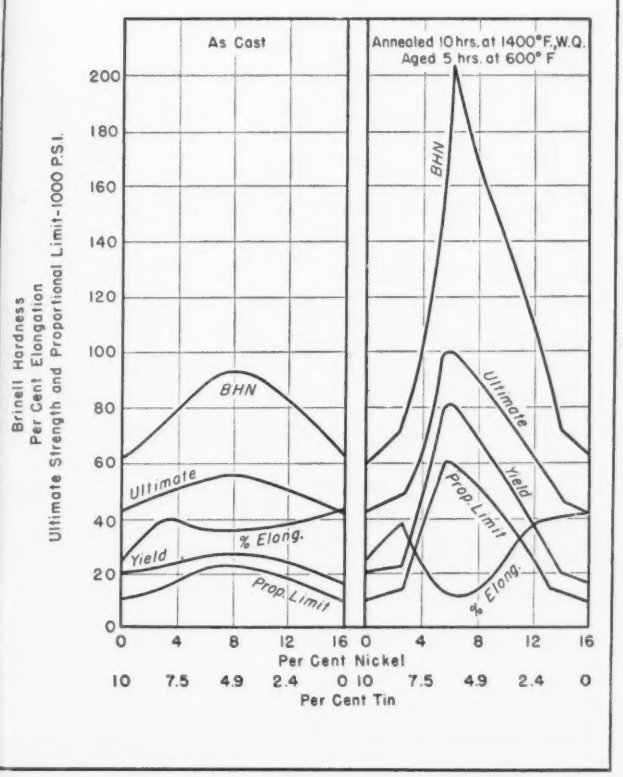
DETROIT

Copper-base alloys provide outstanding advantages to users and producers, alike. These are enhanced when moderate amounts of nickel are utilized.

HOW NICKEL IMPROVES CAST BRONZE

For instance . . . small percentages of nickel refine the grain, strengthen the alloy, and improve its resistance to wear and corrosion. By increasing fluidity in the casting mixture, nickel affords a wider casting range, and thus helps to minimize misruns and to improve density and pressure-tightness.

Effect of Nickel on the Mechanical Properties of Sand Cast and Heat Treated Tin-Bronze Alloys



RESPONSE TO HEAT TREATMENT

In certain cases, a moderate nickel content makes possible the response to heat treatment which increases the tensile and compressive strength, being particularly effective in raising elastic properties.

Certain cast nickel bronzes are very responsive to heat treatment. The hardness of an alloy containing 7.5 per cent nickel and 8 per cent tin, for example, can be increased from about 75 to 277 BHN by appropriate heat treatment.

TYPICAL APPLICATIONS

Typical applications of nickel bronzes include worm wheels, gears, liners, bushings, bearing backs, valve guides and seats, pumps, valves, fittings, plumbing goods, miscellaneous structural and engineering uses.

COUNSEL AND DATA

Nickel alloyed bronzes offer significant advantages. Whatever your industry, we solicit the opportunity to help you with counsel and data pertaining to these economical alloys.

EMBLEM OF INCO SERVICE TRADE MARK

Because of unusually heavy industrial and defense demand, rationing of nickel has been in force since July 1st. However, we believe that dissemination of technical data and service experience can help to promote the intelligent utilization of critical materials, so essential in these times. We shall, therefore, continue to issue information on new developments and user experience with nickel-containing materials.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

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CHATTANOOGA, TENN. - ST. LOUIS, MO.
CROWN HILL MEANS QUALITY SEACOAL

FIGURES FROM BUREAU OF MINES
DEPT. OF INTERIOR OF THE U. S.
(Moisture Free)

PROXIMATE ANALYSIS

Volatile Matter (V.C.M.)	38.9%
Fixed Carbon	57.4%
Ash	3.7%
	100.0%

ULTIMATE ANALYSIS

Hydrogen	5.4%
Carbon	82.0%
Nitrogen	1.6%
Oxygen	6.6%
Sulphur	.7%
Ash	3.7%
	100.0%

★ Star performer Crown Hill Seacoal Facing has real foundry appeal:

A. It vents the mold quickly.
B. Eliminates hard spots.
C. Makes peeling easy.

There's a reason, in fact three reasons for these advantages: (1) Crown Hill is made from selected, high volatile flash coal; (2) it has extremely low sulphur content; (3) the fusion point of the little ash residue is 2980 degrees F.

Crown Hill does cut cleaning costs substantially. Try Crown Hill Seacoal Facing . . . made by the long-time friend of the foundries—The Federal Foundry Supply Company.

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(City & Zone)_____ (State)_____

Reports from all types of foundries show ROTOBLAST saves up to $10,000 a year AND MORE!

ROTOBLAST saves labor — industry's biggest single cost item. In each of the three typical ROTOBLAST cases tabulated below, *savings on labor* averaged well over $100 a week. In addition, cleaning took less time and power costs decreased.

Saved with ROTOBLAST

ROTOBLAST UNIT	CASH SAVED	NAME OF USER
Table-Room	**$11,102** *on labor alone*	Lewistown Foundry, Lewistown, Pennsylvania
Room	**$10,160** *on labor alone*	Harris-Seybold, Cleveland, Ohio
Barrel	**$5,080** *on labor alone*	Yates-American Machine Co., Beloit, Wisconsin

If you want savings like this, specify Pangborn ROTOBLAST. Whether you clean castings or forgings, grey iron, brass or steel, you'll find ROTOBLAST saves money and speeds up cleaning with no sacrifice in quality!

ROTOBLAST

ROTOBLAST

$SAVES LABOR: *One ROTOBLAST machine and operator can do as much as a two-man crew and old-fashioned equipment.*

$SAVES SPACE: *In many cases, one ROTOBLAST machine replaces five or more old-fashioned machines, requires less space.*

$SAVES TIME: *Cases on record prove ROTOBLAST can cut cleaning time up to 95.8% compared with old-style methods.*

$SAVES POWER: *Modern ROTOBLAST uses but 15-20 h.p. compared to old-fashioned equipment requiring 120 h.p. for same job.*

$SAVES TOOLS: *On work cleaned with ROTOBLAST, cutting tools last up to ⅔ longer because no scale is left to dull edges.*

. . . and these savings mean INCREASED PROFITS for you!

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment.

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Cleans These Intricate Castings for 2¢ EACH!

An actual case report from
Garden City Foundry, Stoughton, Wis.

"Reduced our cleaning costs!" says superintendent John Selgrath about Garden City's ROTOBLAST team of Table and Barrel. Costs on two intricate flywheel castings back up his statement. The smaller 31 lb. piece is cleaned by the ROTOBLAST Table shown above for only *2c each!* Larger 49 lb. flywheels are cleaned in the Barrel for just 5.3c each—and both figures include *all labor, power and operating costs!*

But that's not all. Breakage used to seriously hamper production, but no more. Cleaning is faster too, and now Garden City states it can give its customers *any finish they want!*

IF YOU WANT TO CUT COSTS TOO, find out about Pangborn ROTOBLAST. There's a ROTOBLAST Table, Barrel, Table-Room and Monorail Cabinet for every blast cleaning job. To find out how modern Pangborn ROTOBLAST equipment can save you money, send for Bulletin 214. It contains valuable specifications, performance data and photographs. For your copy, write today to: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md.

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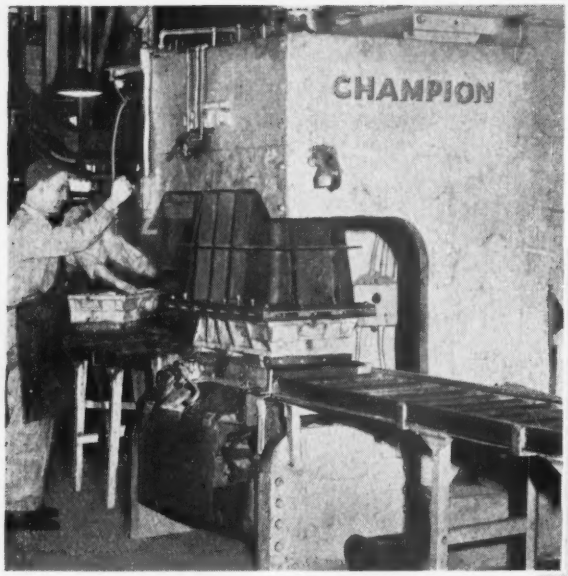
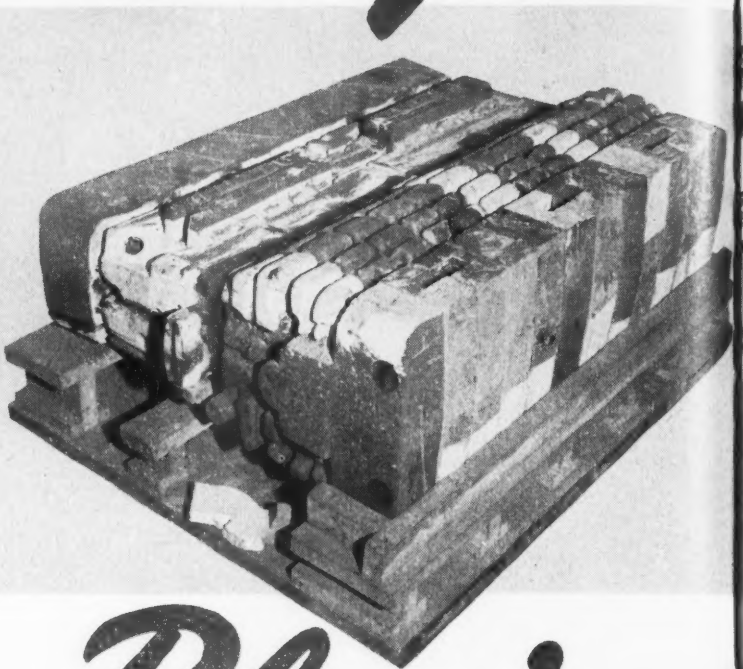
BLAST CLEANS CHEAPER

with the right equipment for every job

Big or



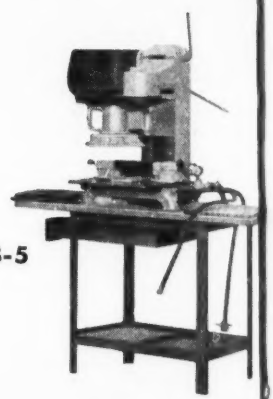
Seventeen pieces combine to form this 660-lb. core for International Harvester Diesel Engine casting. The largest sections, weighing nearly 60 lbs., are blown on the Champion CB-400, shown above.



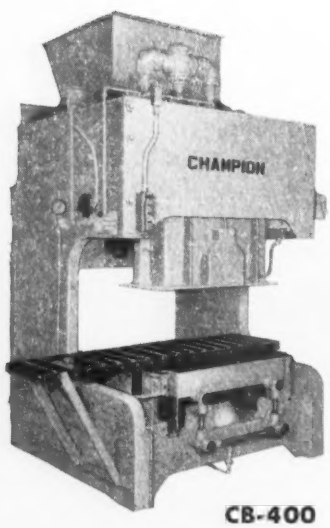
You can Blow 'em

How big did you say that core is? Never mind, there's a Champion Core Blower to handle it. Look at the line-up below, beginning with the daddy of them all, the CB-400, on down to "Junior", the CB-5, and whatever your requirements, one or more of these machines will fill those core boxes, and FAST! It takes no longer to blow 250 pounds of sand into a large core box on the CB-400, than to blow a gang of 2-ounce cores on the smallest model.

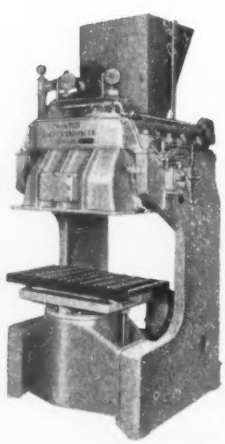
Try it yourself, and see!



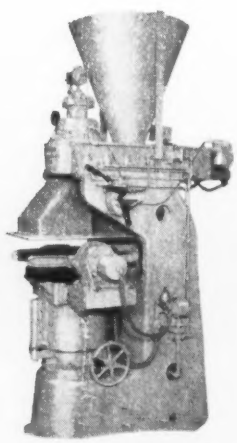
CB-5



CB-400



CB-18



CB-15

CB-12

CB-

Small-

Small, intricate shapes offer no problem when you blow them on a Champion. The cores and castings at the left, shown through courtesy of Federal-Huber, come out just as fast as the operator can manipulate the box and air lever.

all ON CHAMPIONS!

Every Champion core blower, from the largest to the smallest, possesses every feature that gives every Champion its outstanding speed, safety and precision. Operators using Champion Core Blowers find their work easy to learn and pleasant to perform. All effort is supplied by the machine, the operator merely directs and controls it. Hence there is no fatigue to slow down production toward the end of the day.

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Champion engineering, based on a vast experience, has provided the strength, accuracy and simplicity of operation on every size Champion Core Blower, that makes them favorites with operator and management alike, in leading foundries the world over.

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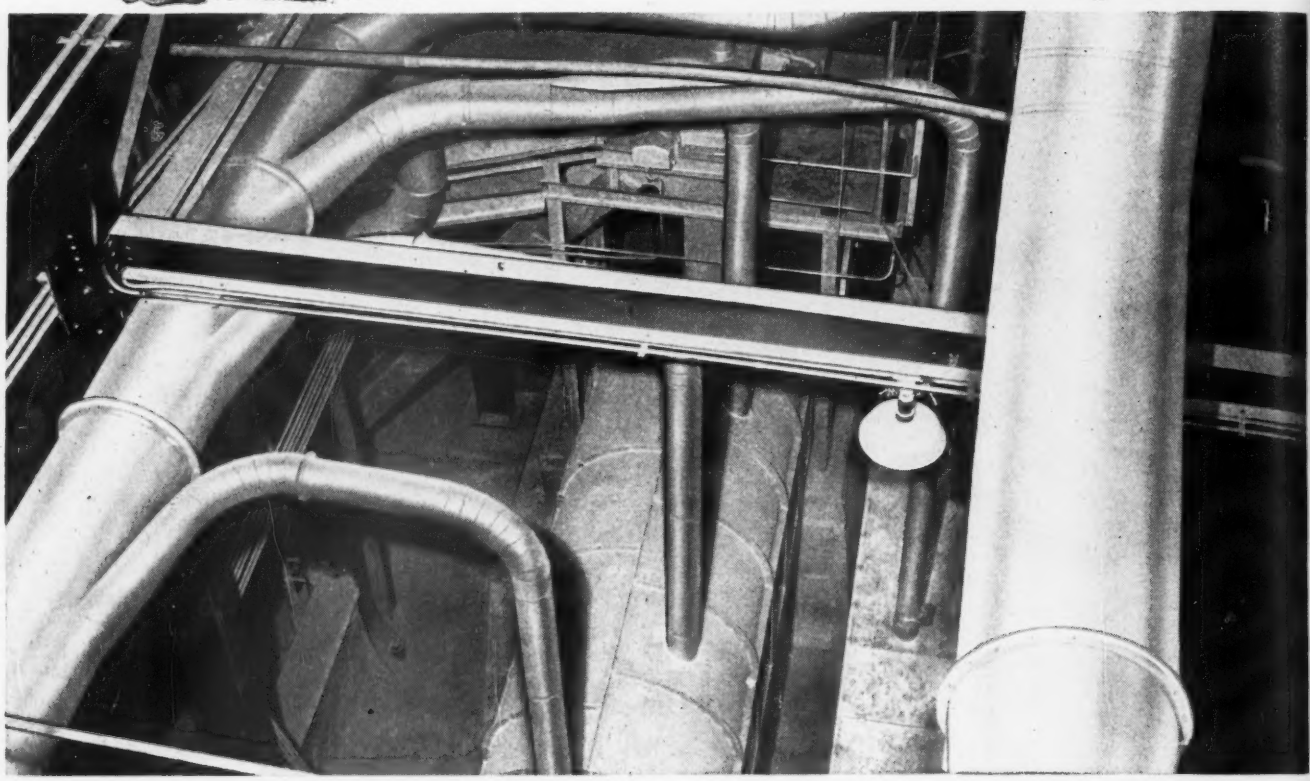
...through a Kirk & Blum Dust Control System



Dust Control System on Rotary Breaker Screen and sand handling system in a casting plant of one of the nation's largest steel companies.

The large volumes of dust produced in the sand handling operations of this plant are not a problem. As soon as dust is formed, it is removed by the KIRK & BLUM Dust Control System.

One of the many KIRK & BLUM foundry installations, this Dust Control System meets every requirement of the American Foundrymen's Association code; heavy gauge piping has flanged joints and convenient clean-out doors.

Hundreds of plants, large and small, have found it pays in *greater operating efficiency* to have a dust or fume control system designed and installed by experts. For all three—design, fabrication and installation—call on KIRK & BLUM.

If you need a new dust control system . . . or more capacity in an existing one, contact KIRK & BLUM. They'll gladly prove the money-saving efficiency of systems by KIRK & BLUM, specialists in dust and fume control for more than 43 years. For Booklet, write The Kirk & Blum Mfg. Co., 2808 Spring Grove Ave., Cincinnati 25, Ohio.

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For all three—call on K&B

FOR CLEAN AIR... THE INVISIBLE TOOL

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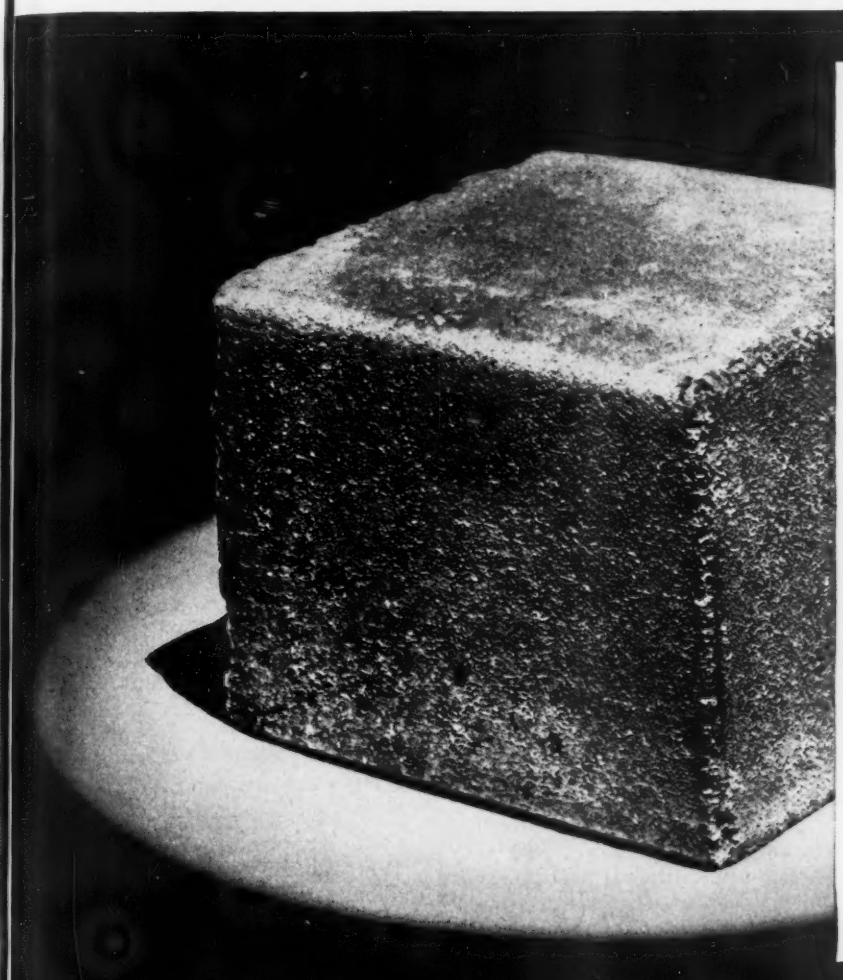
DUST CONTROL SYSTEMS

Providing Effective Deoxidation IN THE CUPOLA



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Super-heated iron of greater fluidity is produced. Cleaner, sharper castings are poured. Foundry variables are lessened.

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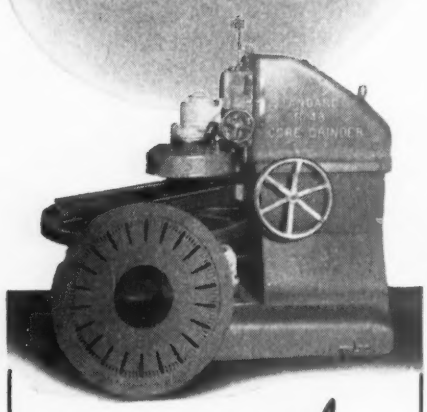
outstanding
advantages



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With the EDITORS

UP FRONT: This month we find ourselves right up front in a section of the magazine which has been reserved almost exclusively for advertising. While we may bark a bit now and then, we hope our new neighbors will not object too much to this editorial intrusion. The new location advances the press date of this department, so that from now on Associate Editor Bob Herrmann will be forced to start the pressure for copy just a bit earlier. Editors, you know, are notorious procrastinators.

—o—

Greater Service: Moving day for this department is just part of a program of enlargement and improvement of service to readers which FOUNDRY accentuates with this issue. The changes which have been made are the result of a careful study on the part of the editors and the business department and include a new front cover, added editorial features, and the rearrangement of certain departments. Perhaps you will be interested in a few of the details.

—o—

Cover: When removing this issue from the mailing envelope, we hope you were impressed with the new cover, which now joins the ranks of editorial pages. Future issues will present interesting photographs having a foundry industry flavor, and will give you brief information on some of the interesting features to be found inside the magazine. Of course, this is not the first time since John A. Penton got out the first issue back in September of 1892 that the editors have used the front cover, but we feel the present style is the most attractive. Before the next issue goes to press, we are going to prepare a little study on how the front covers of FOUNDRY have been used for the past 58 years.

—o—

News Report: An entirely new feature, "FOUNDRY News Report," is presented a little further along on pages 33 and 34. The reason behind this particular department goes back to the mechanical problem of printing the magazine. While the Penton Publishing Co. has a large and modern printing establishment at the main office in Cleveland, the tremendous demands on these facilities to print the weekly metalworking magazine *Steel*, the monthly magazines FOUNDRY, *Machine Design* and *New Equipment Digest*, plus a number of magazines for other customers, require an extended printing schedule for the monthlies. FOUNDRY editorial material starts to press about 14 working days before the binding date, and the last form goes to press about 8 days before mailing the publication. To eliminate this time lag in presenting the latest press time news of the industry, plus prices on pig iron, coke, iron and steel scrap, and nonferrous metals, the "FOUNDRY News Report" will be printed as an insert just before the issue goes to the bindery. We believe this new service will prove valuable to many readers, especially at a time when developments in Washington are having such an important bearing on future trends of foundry operations.

—o—

Letters: Our old department "Readers' Comment" has been enlarged and moved up front (pages 68, 70 and 72 of this issue.) While we realize that most foundrymen are rather hesitant in "taking the pen in hand," we hope many will accept this invitation to write us a note on subjects which are of interest and importance to the 45,000 readers of FOUNDRY.

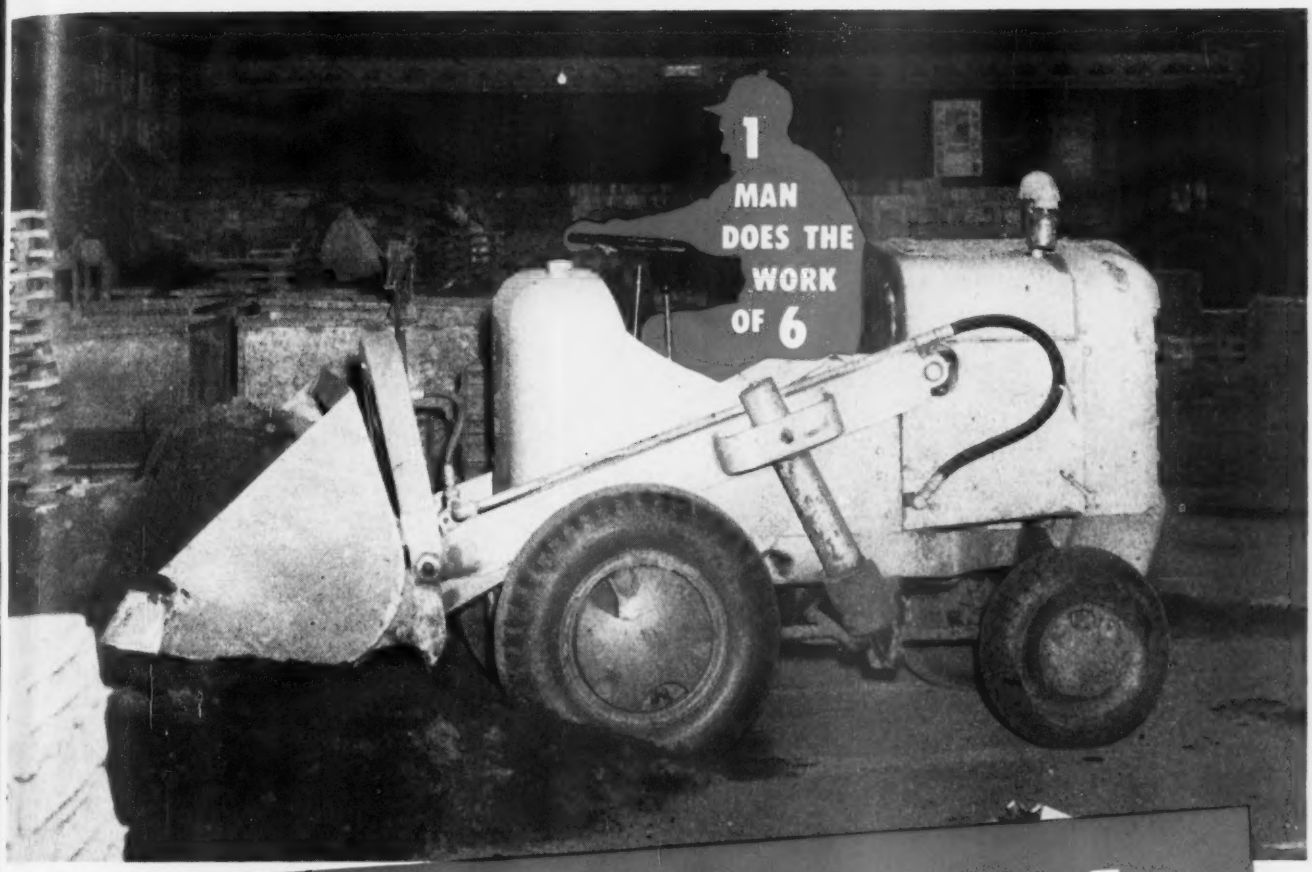
—o—

Into the Night: We could go on telling about this issue far into the night. For example, we should mention the new ABC section for young foundrymen, the beginning of a series on the cupola by our advisor, B. P. Mulcahy, or the hours that Robin Allen and Don Cadot devoted to the art layouts. But space does not permit. Anyway, we hope you will find even greater usefulness in this issue and those to follow.

—o—

Wind and Snow: From now on Nov. 25 will be remembered as the date of the "Big Wind" down east and the "Big Snow" in the Ohio-Pennsylvania section of the country. In excess of 23 inches of snow fell on Cleveland, Youngstown, Pittsburgh and many other cities, but high winds produced drifts as high as 8 feet. All transportation was at a standstill for several days, industrial establishments were closed and the loss ran into the millions. The editor is

(*Concluded on page* 14)



PAYLOADERS Can Help You Too

FOUNDRIES and metal-working plants in increasing numbers are installing Hough PAYLOADERS because they are a sure, proven way to lick rising costs, solve manpower shortages and increase output.

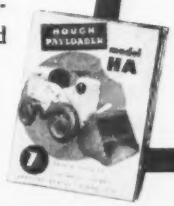
A PAYLOADER more than pays its way every day — actually pays for itself within a few months doing the many jobs listed here and doing them faster and cheaper . . . releasing manpower for more productive work.

The 12 cubic foot Model HA shown is the smallest of the PAYLOADER line that includes graduated sizes up to 1½ cubic yard bucket capacity. Every PAYLOADER is a complete, Hough-built tractor-shovel specifically designed with multiple reverse speeds and other features that insure fast, low-cost bulk material handling. They are backed by 30 years of material-handling equipment manufacture and are sold and serviced by a world-wide Distributor organization. The Frank G. Hough Co., 703 Sunnyside Ave., Libertyville, Ill.

Literature on any size PAYLOADER will gladly be sent without obligation.

On These Jobs

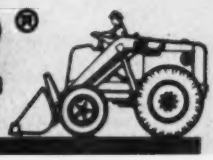
Unload box cars.
Carry sand, coke, scrap, limestone, etc., to storage.
Transport and distribute sand to molding stations.
Remove used sand from floors.
Windrow sand for the cutter.
Charge mullers, hoppers, tumbling barrels.
Feed conveyors, elevators, mixers, screenerators.
Clean up gangways, aisles and other areas.
Handle coal, ashes, cinders.
Handle scrap and small castings.
Maintain private roadways.
Do crane work—haul, push.
Remove snow.



SAY "HUFF"

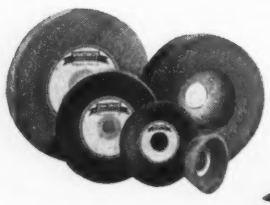
PAYLOADER®

THE FRANK G. HOUGH CO. • *Since 1920*



NATIONAL *Mechanized* EQUIPMENT

The foreman's walking on air..



SIMONDS ABRASIVE CO.

grinding wheels

Production up . . . costs down . . . and rejects rare as a February heatwave. No wonder the grinding foreman is uplifted. And here's the reason. He's using grinding wheels exactly suited to his jobs. They're Simonds Abrasive Company wheels . . . part of a complete line including grinding wheels, mounted wheels and points, segments and abrasive grains . . . all accurately specified, rigidly tested and scientifically produced under complete quality control by Simonds Abrasive Company, a major manufacturer of grinding wheels for over 50 years. Write for free data book.

SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA. DISTRIBUTORS IN PRINCIPAL CITIES

Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

(*Concluded from page* 12)

particularly proud of the fact that on Monday morning, Nov. 27, six out of seven FOUNDRY editors arrived at the office, although the town still was tied in a knot. Pat Dwyer, who lives way out in the east end of the metropolitan district, really was snowed in, and it took days to get him shoveled out and back at his desk. Down east Jack Ahrens was right in the center of the high wind which provided gusts over 100 mph. Jack had neither light nor heat from 6 a.m. Saturday until the following Tuesday afternoon. Four trees on his property blew down, and one fell on the house, damaging the roof. In trying to saw a tree that was blocking the driveway, Jack injured his back, but reports it is on the mend. Man still has not made too much progress in protecting himself from the elements when old Mother Nature goes on a spree.

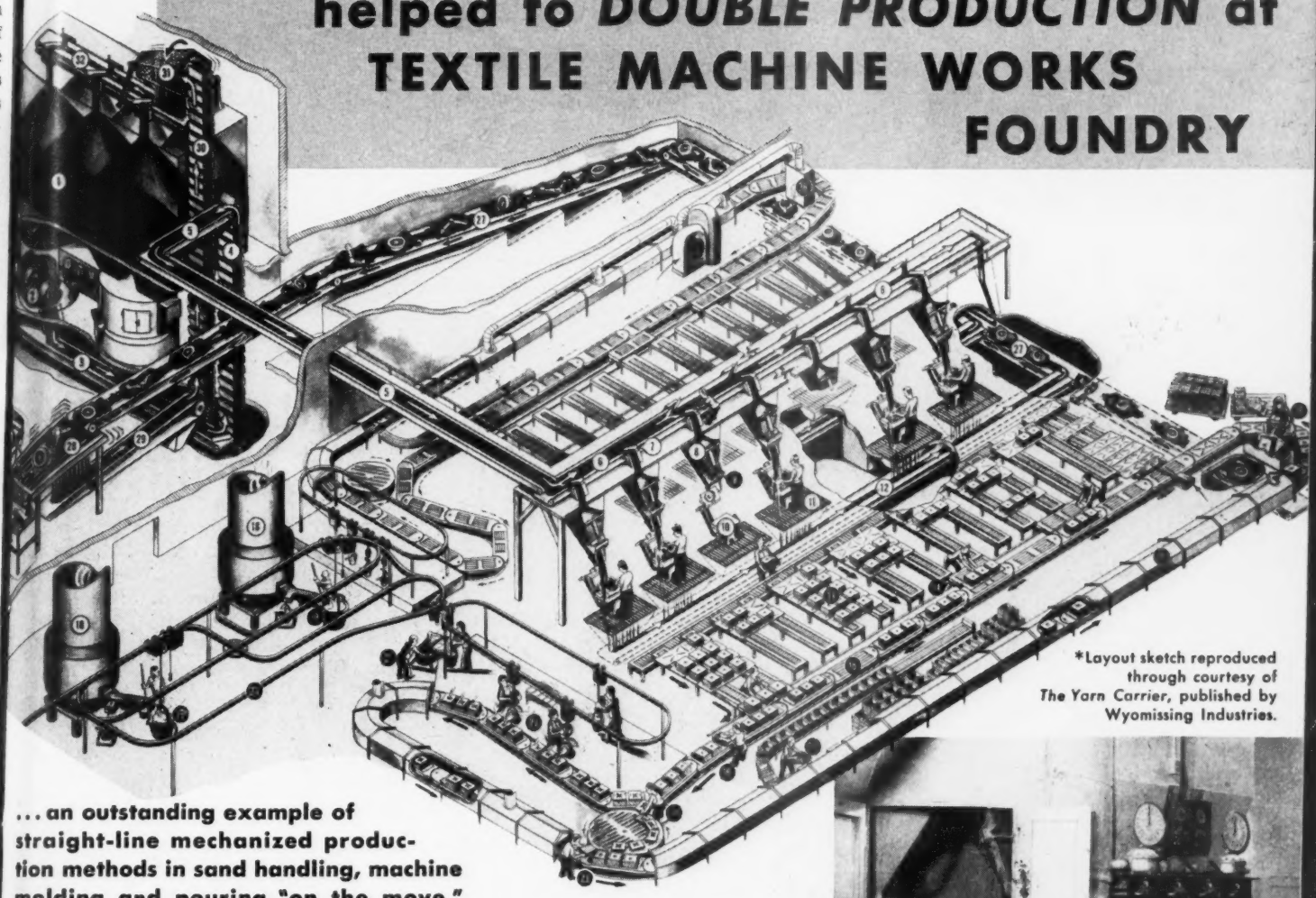
—o—

Announcement Party: One of the best coming out parties for an industrial product that we have been privileged to attend was that staged by the Whiting Corp., Harvey, Ill., on Nov. 15, to introduce the new Trackmobile, an ambidextrous unit for moving railway cars which operates on the track or on the ground. A large group of railroad executives, industrialists and press representatives

President Stevens Hammond of Whiting, operating the new Trackmobile

watched a demonstration of the unit moving passenger and freight cars with ease and speed at the Grand Central Station in Chicago. The demonstrating unit was equipped with a mobile radio, so that the operator of the switching unit, William Gage of Whiting's research and development department, was able to keep the audience informed with every move. After the demonstration the guests were entertained at luncheon at the Union League Club. Special thanks and a word of praise go to Stevens Hammond, president, and Anthony De Young, advertising manager of Whiting, and Jim Bolt of the Waldie & Briggs advertising agency, for a fine party. FOUNDRY was represented by Al Johansen, Erle Ross and the editor.—F.G.S.

How NATIONAL *Mechanized* EQUIPMENT helped to *DOUBLE PRODUCTION* at TEXTILE MACHINE WORKS FOUNDRY



*Layout sketch reproduced through courtesy of *The Yarn Carrier*, published by Wyomissing Industries.

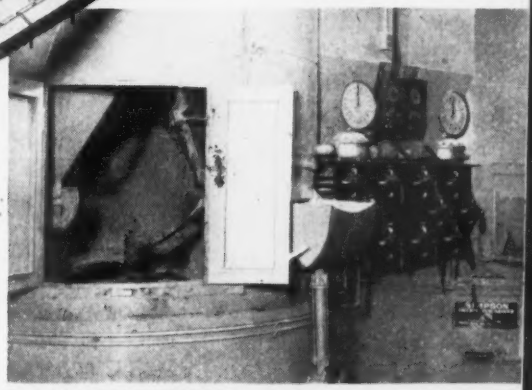
...an outstanding example of straight-line mechanized production methods in sand handling, machine molding and pouring "on the move."

TEXTILE MACHINE WORKS, Reading, Pa., are already famous for operating one of the largest, most modern foundries in the country. Now, adding to that accomplishment, this progressive company has completed installation of the highly mechanized unit shown here* for large-scale production of small and medium size gray iron castings. Designed and installed by National Engineering, in conjunction with Mr. H. P. Good and the Foundry Division of Textile Machine Works, reports on this equipment show these results:

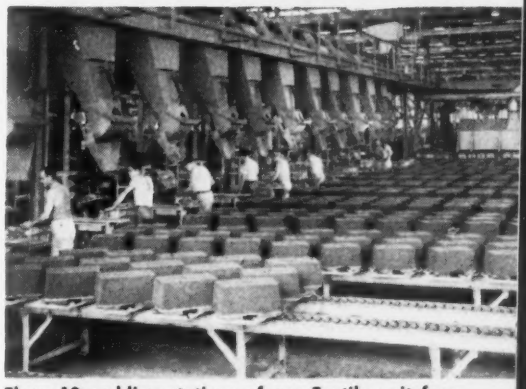
> *Production has been practically doubled, without increasing floor space. Quality has been maintained, without any increase in scrap percentage. Production per molder per day has nearly tripled. Costs have been reduced considerably, witb comparable increases in molders' earnings.*

With the appreciable per pound saving in casting cost made possible through this mechanization program, the entire investment is expected to pay for itself in 5 years. Here, then, is a practical, *mechanized* answer to the problem of increased production of highest quality castings at lower cost.

Let a National Engineer show you how these methods can be applied to solve your production problems. Write for further details.



Two SIMPSOM MIXERS at Textile Machine Works, each producing 3500 lb. batches of properly prepared sand.



These 12 molding stations of one Textile unit face 15 stations of the second unit—both served by individual power mold conveyors.

IMPSON Intensive MIXERS

NATIONAL *Engineering Company*

608 Machinery Hall Bldg. • Chicago 6, Illinois

Manufacturers and Selling Agents for Continental European Countries—George Fischer Limited, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

Send for Bulletin describing the complete Textile Machine Works installation. Write for your copy today.

LOWE Electric Sifter

A high quality sifter featuring screening area, enclosed ball motor, more shoveling room, rugg struction and trouble-free op Saves time and money through fas ing and better-sand conditioning.

buy FEDERAL

Because the type and condition of your equipment directly affect (1) production rate and costs, (2) maintenance costs, (3) quality of product and (4) profit—the selection of equipment becomes an all-important move. It is extremely vital to the successful operation of your foundry that you use only the most modern, most efficient machines. So, when you're ready to buy equipment, make the right move—buy FEDERAL—across the board.

Shown here are only a few of the more than 400 items that go to make up the FEDERAL line—FEDERAL-made products that foundrymen everywhere have been using profitably for years. Call your local FEDERAL representative or write or wire for full information and prices.

FEDERAL FOUNDRY manufactures all equipment illustrated.

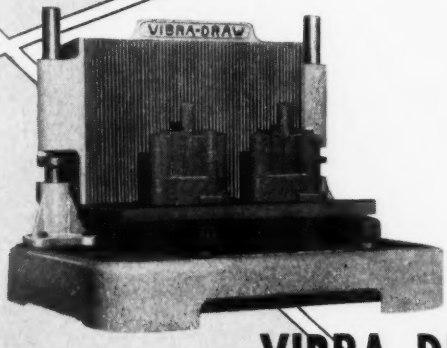
FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

MAKE THE RIGHT MOVE

when you buy equipment...

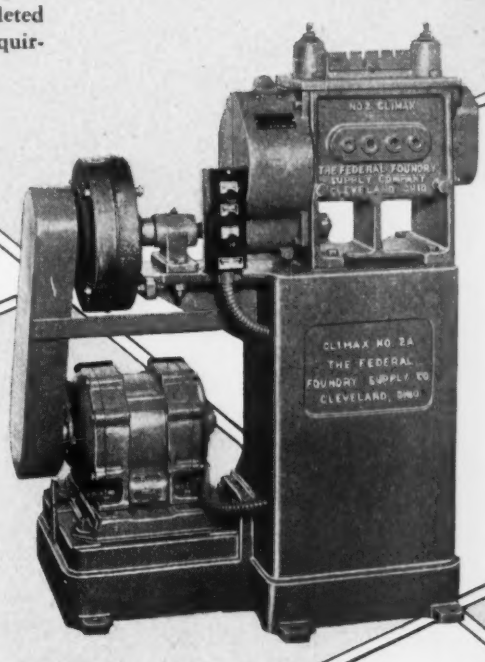
SHUR-SPOT SPRUES

For squeezer-made molds. SHUR-SPOT squeezes down with the sand. When squeezer board is removed, SHUR-SPOT pops up to be lifted out. The result is a fully completed and properly located pouring sprue, requiring no finishing.



VIBRA-DRAW

With any core blower, you make cores only as fast as you draw them. VIBRA-DRAW draws cores as fast as SAN-BLO makes them. Simply place core box against vibrating head and lift box. A perfect core every draw—and fast!

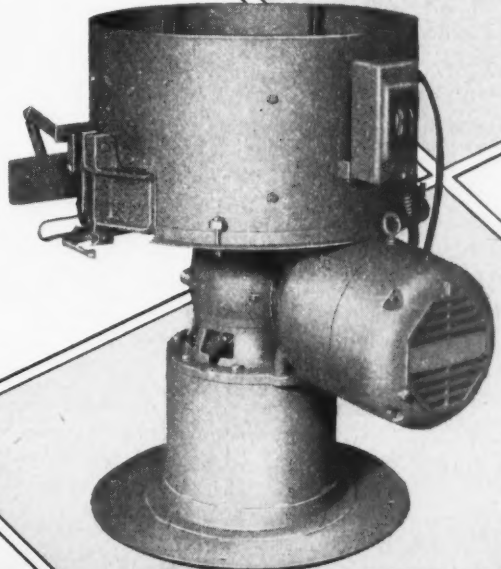


CLIMAX Wire Straightener

Wire is hard to get, so it's important that you straighten and re-use wires and rods. The CLIMAX, an old friend in many foundries, is the ideal machine for this job. Handles random lengths. Operated efficiently by unskilled labor. Wide variety of models.

AN-BLO

he first all-purpose sand blower. otor driven plows move sand in ow head to conserve full air pres- re for aerating and carrying sand o core box. Blows any sand you n hand-ram, regardless of bond ength or moisture. Blows single es up to 40 lbs. each, or 40 lbs. of all cores, without refilling blow ead. Any type box. One blow plate, e universal vent plate. The fastest, ost efficient sand blower ever de- loped. Ideal for jobbing foundries.



WHIRLMIX Sand Mixer

The first and only mixer with flexible, whirling, rubbing arms. Produces fluffy, aerated, thoroughly mixed sand without overheating, or crushing sand grains. Small, compact, easily moved—yet a big producer, for it mixes 4,000 lbs. of sand per hour.

DETROIT PUBLIC LIBRARY

The FEDERAL FOUNDRY SUPPLY Company

4600 EAST 71st STREET · CLEVELAND 5, OHIO

CHICAGO DETROIT MILWAUKEE

NEW YORK CHATTANOOGA RICHMOND, VA. LOS ANGELES

Longer Nozzle Life *Every* Time

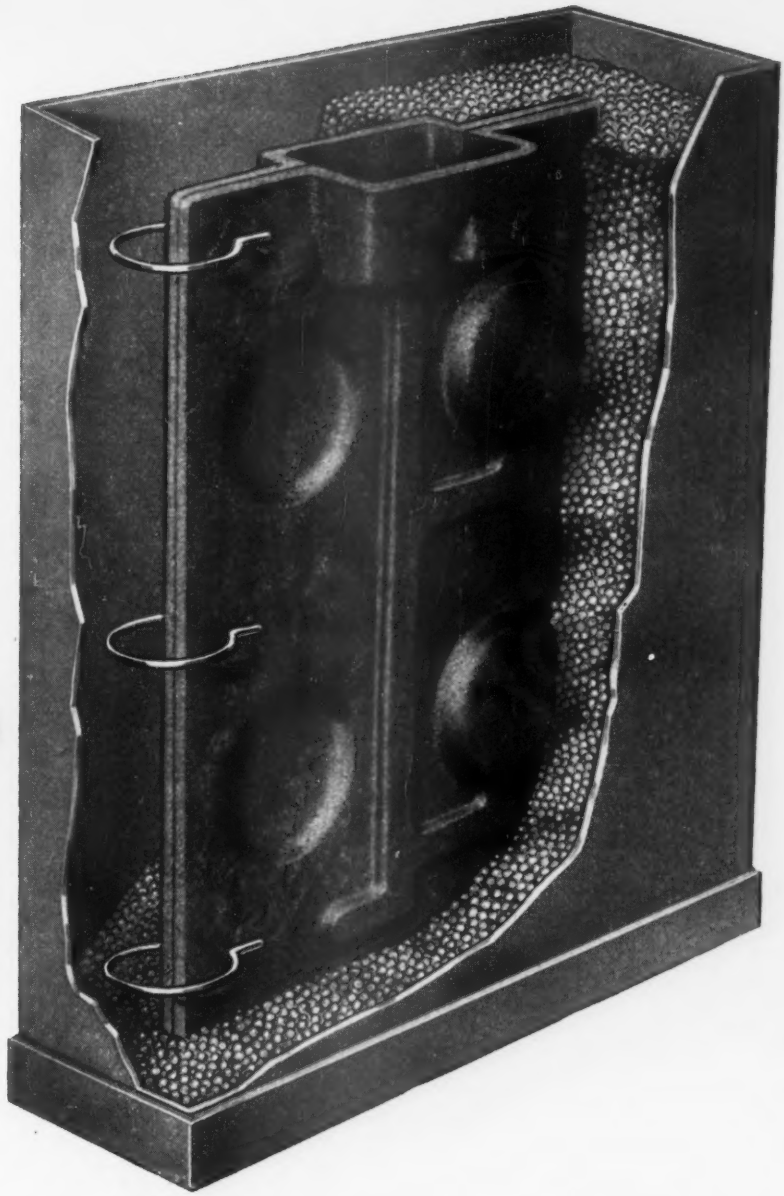
IF YOU are looking for a way to increase nozzle life in your blast cleaning department—if you wish to do away with costly time-wasting while worn-out nozzles are replaced with new nozzles—if you are searching for means to improve blasting efficiency and increase production—there is one answer for all three problems: NORBIDE Nozzles. Made of Norton Boron Carbide—the hardest man-made material—NORBIDE Nozzles will outwear conventional types fifty to one. This same wear-resistance enables these nozzles to retain peak efficiency for a long period with resultant production increases. Air consumption is reduced 10 to 20%. Stream contour and abrasive velocity are maintained.

For information as to size and price write for Bulletin No. 543

NORTON COMPANY
Worcester 6, Massachusetts

NORTON **NORBIDE PRODUCTS**

Could You Make This Sand Mold in *6 Minutes?*



USING BAKELITE PHENOLIC RESIN as the binder, sand molds like this one were turned out repeatedly by the "Croning" Process in just six minutes each—at a demonstration before hundreds of foundrymen at the 1950 Foundry Show in Cleveland.

Today the "Croning" Process for making foundry sand molds and cores is opening the eyes of foundrymen everywhere to new economies, better castings, and greater profit opportunities.

Principal advantages of the process are:

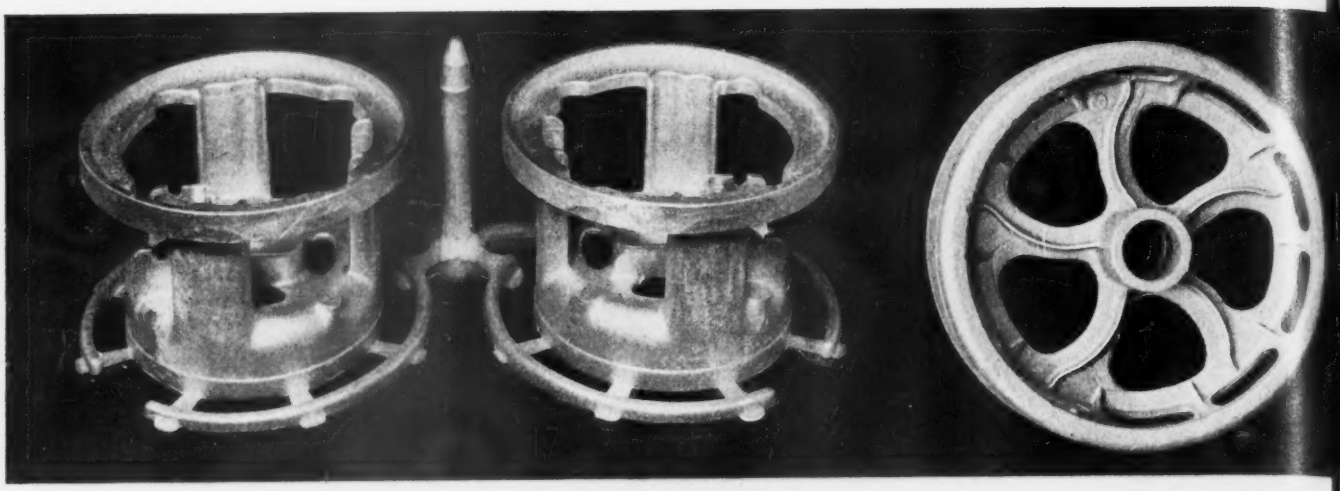
- **Pieces are cast closer to size, thereby saving metal.**
- **Smooth surfaces obtained are free from burnt-on and burnt-in sand, requiring little or no finishing such as shot-blasting or other types of abrading.**
- **Tolerances of .002 to .003 of an inch—usually only a finish cut required instead of a rough cut followed by a finish cut.**
- **Long baking and curing are not required, and there is less tie-up of equipment, providing increased productivity.**
- **Molds and cores are only thin shells as contrasted with solid cores and molds for conventional sand casting, which gives great savings in sand and sand preparation.**
- **Extremely thin sections can be cast.**
- **The process lends itself readily to mechanization.**

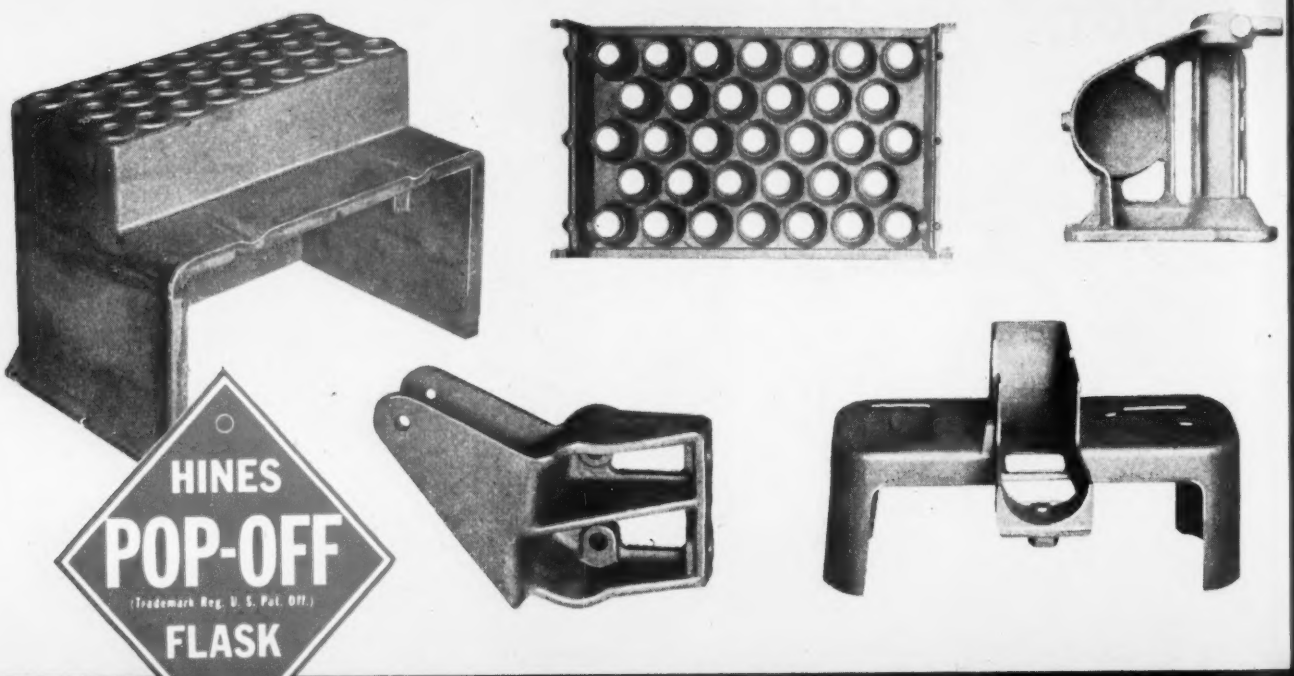
If you have not already sent for your free, illustrated, 16-page booklet, "BAKELITE Phenolic Resins for the 'Croning' Process," send for it today. It gives specific information on BAKELITE Resin binders, wetting agents, and parting agents especially developed for the process. It also includes data on types of sands required, as well as pattern preparation and core making. Write Dept. BH-291 for your copy.

Bakelite *Phenolic* **BONDING RESINS**

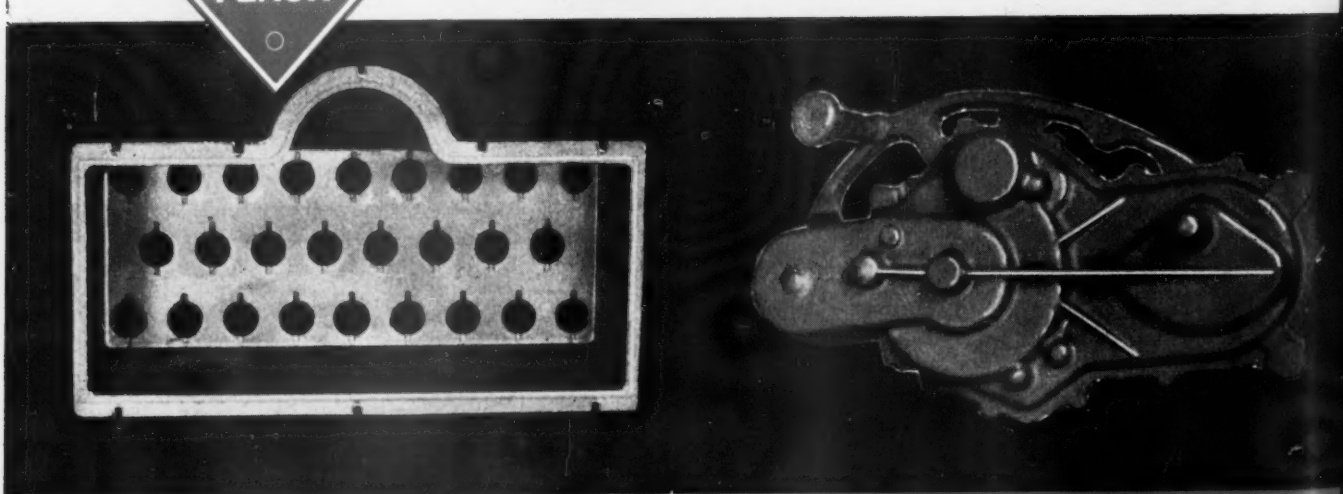
BAKELITE DIVISION
UCC

BAKELITE DIVISION, *Union Carbide and Carbon Corporation,* 30 East 42nd Street, New York 17, N.Y.





HINES
POP-OFF
(Trademark Reg. U. S. Pat. Off.)
FLASK



THE HINES

3431 WEST 140th ST.

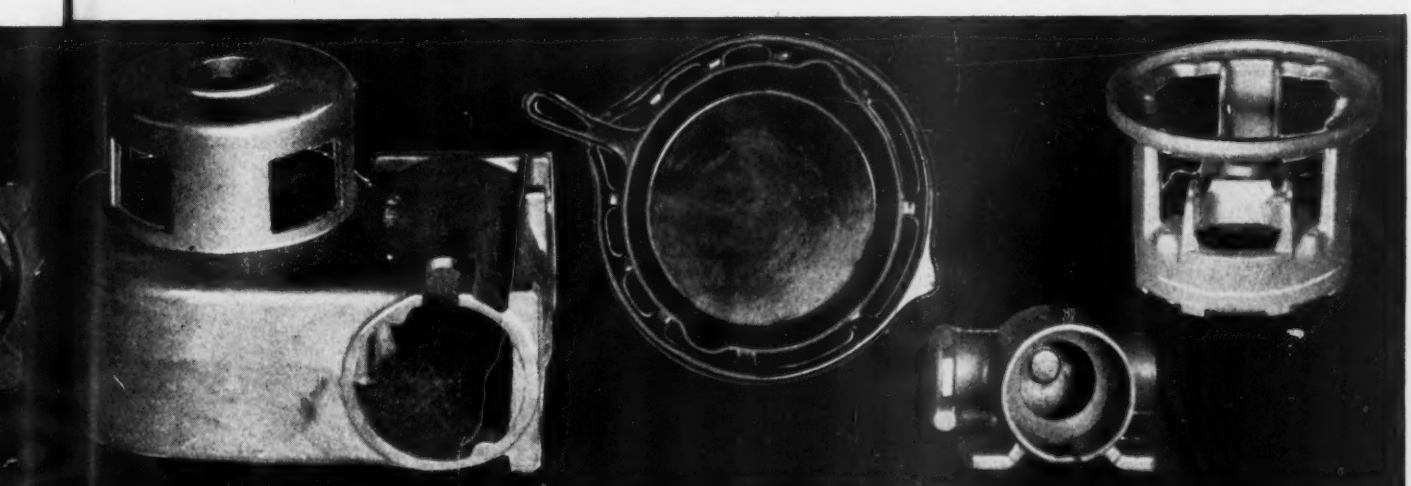
HINES

POP-OFF

FLASKS

Lowered Costs and Raised Production on these jobs....

Just a few examples of castings formerly made in snap flasks and tight boxes now being made in Hines Pop-Off Flasks at a greater saving.



SF FLASK CO.

CLEVELAND 11, OHIO

New.... Improved

DELTA CORE & MOLD WASHES

SPEED PRODUCTION OF BETTER, CLEANER CASTINGS AT *Lower Cost*

Three easy-to-understand reasons why more foundries use DELTA Core and Mold Washes . . .

1. **MORE PERFECT CASTINGS . . .**
2. **LOWER CLEANING ROOM COSTS . . .**
3. **LESS SCRAP IN MACHINING.**

DELTA CORE AND MOLD WASH-BASE
Mix with silica flour and water to produce finished wash.

•

FOR STEEL
STEELKOAT — Special Core and Mold Wash.

•

FOR GRAY IRON AND MALLEABLE
Grakoat — Blackoat — Hi-temp.

•

FOR GRAY IRON
Blackoat S-5 — A new and different wash.

•

FOR NON-FERROUS METALS
Non-FerrusKoat.

•

FOR ALL SAND CAST METALS
THERMOKOAT — It's Plasti-Lastic.
PYROKOAT-HI-Speed.

•

FOR UNUSUALLY HIGH TEMPERATURE CONDITIONS
Z-KOAT — High-fusion-temp. Wash.

•

There is no "just as good" substitute for any DELTA Core and Mold Wash just as there is no substitute for DELTA'S scientific laboratory control of production which safeguards the quality and uniformity of all DELTA Foundry Products. DELTA Research laboratories developed, and pioneered the use of, Plastic-type Core and Mold Washes . . . and still leads the field in the development of new products for improved foundry practices.

NEW mechanical processing and improved chemical formulation . . . developed by DELTA Research . . . have resulted in many decided advancements in both the quality and characteristics of DELTA CORE and MOLD WASHES.

Maximum uniformity of surface coverage is obtained with lower Beaume mixes, using more water. Penetration characteristics are THREE times greater (from 10 to 12 grains deep) and the density of the wash on the surface has been increased 40%.

Due to increased surface density the rate heat conductivity is speeded up and metal in contact with the washed surfaces cools more rapidly, resulting in smoother casting finish.

HERE'S WHY

a. Delta Core and Mold Washes "Anchor" themselves by penetrating from 10 to 12 grains deep into the sand. This bond between the wash and the sand . . . a distinctive DELTA characteristic . . . produces an expansion-resisting coating essential to the production of finer finished castings.

b. The hot strength of Delta Core and Mold Washes increases with each degree of temperature rise from 1800°F to 3000°F providing maximum critical hot strength for all foundry applications.

The higher hot strength of DELTA Core and Mold Washes eliminates surface sand fissuring, excessive sand expansion and distortion.

c. No gas leakage through Delta Core and Mold washed surfaces. Gases produced by decomposition of organic binders in the core sand cannot leak through Delta Core and Mold washed surfaces to contact the molten metal. Only Delta Core and Mold Washes provide this unique and all-important insurance against defective castings resulting from core gas leakage. DELTA Core and Mold Washes insure more perfect castings with finer finished surfaces.

● *Ask for a liberal working sample. You will also receive complete data on how to use DELTA Core and Mold Washes in your foundry.*

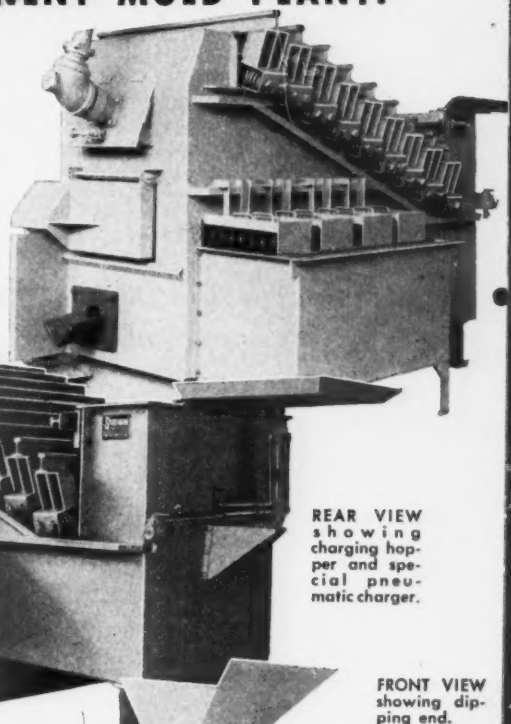
DELTA OIL PRODUCTS CO.

MILWAUKEE 9, WISCONSIN

STROMAN FURNACES

FOR *Every* ALUMINUM MELTING JOB IN *Any* FOUNDRY, DIE CASTING OR PERMANENT MOLD PLANT!

Stroman builds the most efficient, fastest melting and most economical furnaces available. One of these famous four will handle your every melting requirement at great savings.

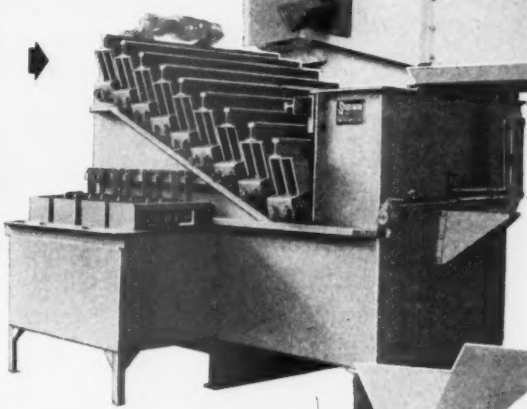


FRONT VIEW showing dip-out box, tapping spout, slagging and cleanout door.

STROMAN TYPE "MC" ALUMINUM DIP-OUT REVERBERATORY FURNACE

Bath capacity from 500 to 10,000 lbs. Aluminum

A combination of breakdown and holding furnaces makes this the most economical furnace ever designed for aluminum melting. It can be used for melting, holding, alloying, fluxing, for either casting or producing ingots. Cold metal does not reach the molten bath. Hot metal is always available for dipping. No iron pots or crucibles to buy. Oil, gas or combination oil-gas fire. Complete automatic controls are available if desired.



REAR VIEW showing charging hopper and special pneumatic charger.

STROMAN ECONOMELT REVERBERATORY FURNACES

Featuring the famous Stationary Lip Pour which assures a constant pouring arc and eliminates the necessity of moving the ladle at any time during the pour. The Economelt is without a doubt one of the finest reverberatory furnaces ever built. Melting speeds for Aluminum, Brass, Bronze, or Grey Iron are unsurpassed. All metal is preheated and melted in suspension in the throat of the hopper. This furnace is showing upwards of 40% savings in fuel costs. Oil, Gas or Combination Oil-Gas Fire. Charging Hoist and Furnace tilting are operated hydraulically. Hydraulic systems are furnished as complete units including operating valves, etc. Capacity in Aluminum up to 10,000 lbs. total bath. Write for Bulletin No. 635 for complete information.

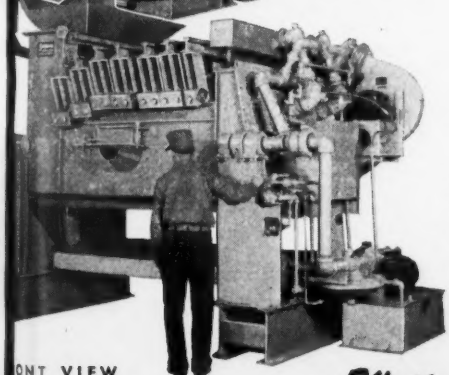
FRONT VIEW from charging end showing a Stroman Skip Hoist.

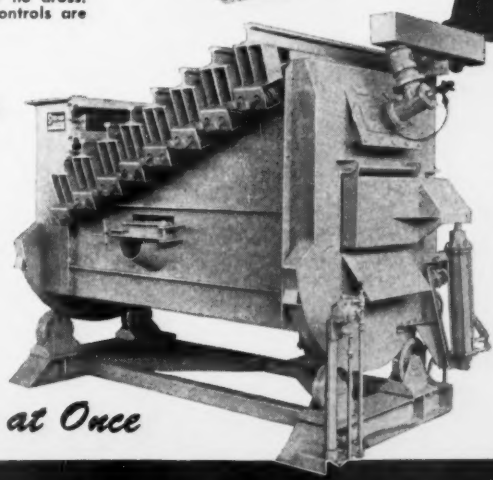
FRONT VIEW showing dipping end.

STROMAN TYPE "DS" REVERBERATORY FURNACE FOR MELTING ALUMINUM

300 and 500 lbs. bath capacities.

The "DS" Furnace provides a complete melting unit for each Die Casting Machine or Small Permanent Molds. It is a small compact unit that may be easily moved to any desired position in the plant. Eliminates the necessity of having both breakdown and holding furnaces. Saves over 50% in fuel costs over any other type. Ingots and returns are melted where they are cast. There is no handling of hot metal except to the die or mold. Metal is melted in a reducing atmosphere and is free from porosity with little or no dross. Complete automatic controls are available if desired.





STROMAN TYPE "SW" ECONOMELT REVERBERATORY FURNACE

Same as Economelt described above except that it is tilted by an air ram, and does not incorporate Stationary Lip Pour. It is excellent as a breakdown furnace for ingot and returns, in die or sand casting and permanent mold plants. Suitable for re-alloying returns or running back machine shop scrap. A large opening is provided below burner equipment to facilitate such operations as drossing, fluxing, alloying, or puddling back light scrap or returns.

ONT VIEW OM BURNER D.

Write for Complete Information at Once

STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

THESE TESTS PROVE Malleabrasive CUTS CLEANING COSTS up to 50% and more!

Results of four recent Malleabrasive tests conducted independently by four typical foundries.

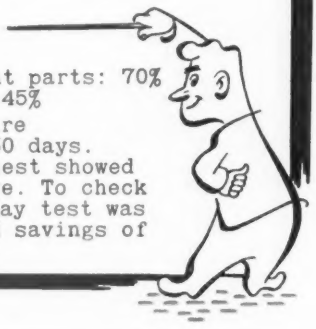
TEST #1

Made by: Cortland Forging Division of Brewer-Titchener Corp.
Total savings with Malleabrasive:

57.2%

Savings on replacement parts: 70%
Savings on abrasive: 45%

Remarks: Two tests were conducted, each for 30 days. Result of the first test showed 35% saving on abrasive. To check results a second 30-day test was run. This test showed savings of 45% on abrasive.



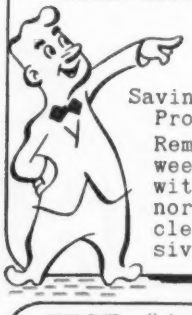
TEST #2

Made by: Reading Gray Iron Castings, Inc.
Total savings with Malleabrasive:

51.8%

Savings on replacement parts: 64.7%.
Production increased: 25.4%.

Remarks: Test was run for seven weeks. Malleabrasive was compared with standard quality abrasive normally used for this type of cleaning. Test also showed abrasive handling cut by ½.



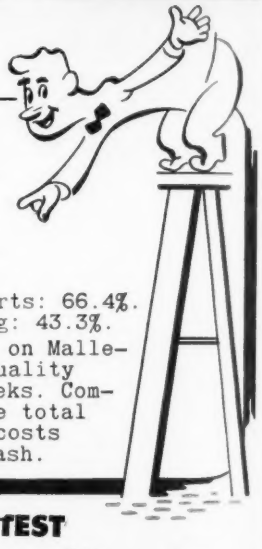
TEST #3

Made by: Crucible Steel Castings Co.
Total savings with Malleabrasive:

35.9%

Savings on replacement parts: 66.4%.
Saved on abrasive handling: 43.3%.

Remarks: Comparative test on Malleabrasive and a standard quality shot was run for seven weeks. Computed on a cash basis, the total 35.9% saving on cleaning costs adds up to $5,283.20 in cash.



TEST #4

Made by: Ohio Forge & Machine Corp.
Total savings with Malleabrasive:

58.9%

Saved on replacement parts: 81.3%.
Saved on abrasive cost: 43.5%.

Remarks: Using Malleabrasive in the cleaning room increased this foundry's production 12.8%. The comparative test held by this company lasted seven weeks, with all costs carefully recorded.

MAKE THIS AMAZING TEST IN YOUR PLANT!

Comparative tests prove Malleabrasive saves from $500 to $2000 per machine *each year!* We'll send you all the data to make your own test. Remember, Malleabrasive has been tested, accepted and uesd for more than *10 years* and is *guaranteed* to outperform conventional abrasives when comparative tests are properly made. Send for your TEST KIT today! Just write to the Globe Steel Abrasives Co., Mansfield.

Packed in new orange striped 100 lb. bags.

†U.S. Patent #2184926
(other patents pending)

PATENTED†

Malleabrasive®

MEMBER FEMA FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC.

THE GLOBE STEEL ABRASIVE CO., MANSFIELD, OHIO

· *MANUFACTURERS OF METAL ABRASIVES SINCE 1907* ·

MOLD DRYING TIME REDUCED *to a minimum*

Automatic Features

ARE INCORPORATED IN

NEW Mold Drying Ovens

by

CARL-MAYER

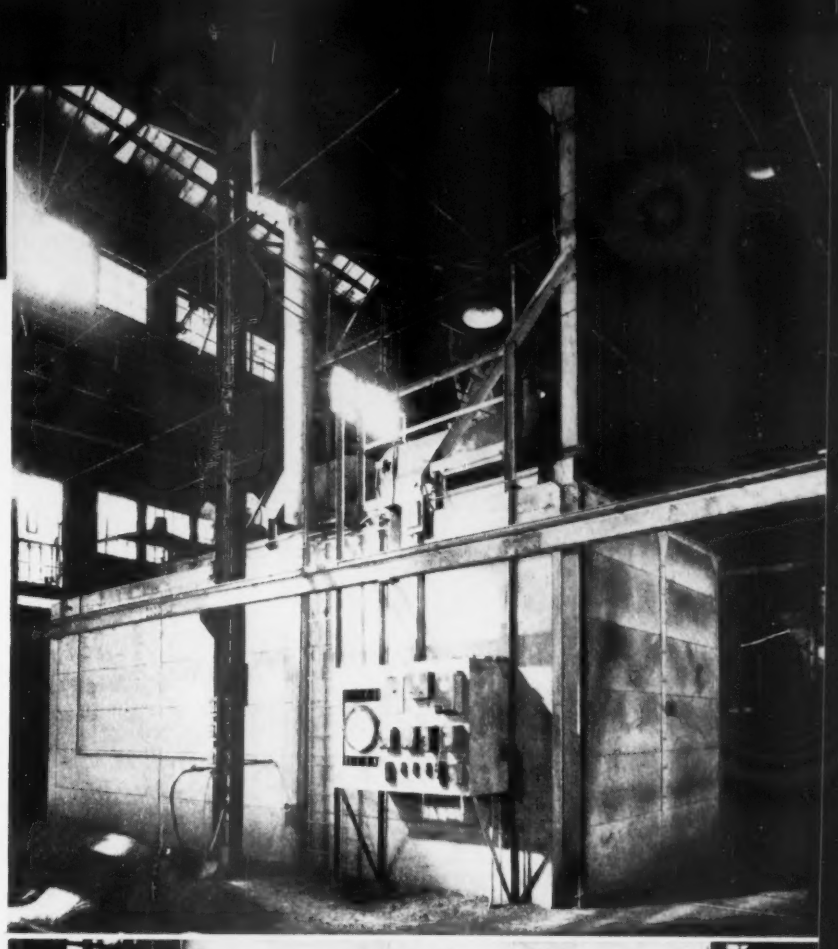
From an article in May, 1950 issue of The Foundry

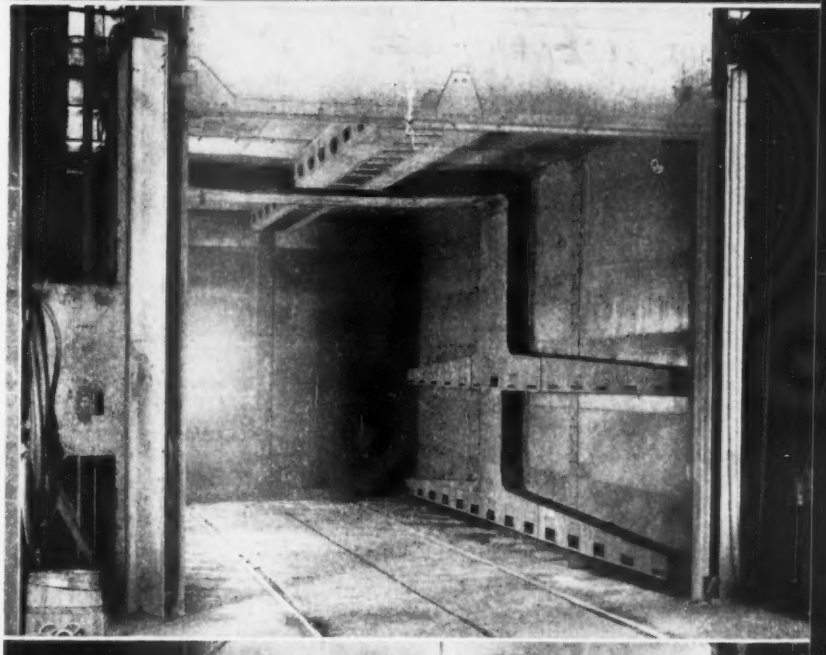
PICTURED here are views of two new modern drying ovens recently installed in the Oil Well Supply Co.'s foundry located in Oil City, Pa. This U. S. Steel subsidiary manufactures oil country machinery of all types and its foundries produce a wide weight range of both iron and steel castings, many of which are cast in dry sand molds. Through the medium of forced circulation and recirculation of hot gases or products of combustion, mold drying time is reduced to a minimum.

Each oven, having a capacity of 120,000 lb, is loaded by a mold-carrying car permanently connected to an under-the-floor automatic car pulling device, which by means of limit switches, cannot be operated until the oven door is wide open. Heat is produced in a dual fuel combustion chamber on top the oven, with an external mix type burner using either natural gas or fuel oil, the burners being provided with automatic fuel changeover devices as well as shutdown safety devices in case of fuel or power failures.

The combustion chamber, which consists of an insulation-covered stainless steel inner lining encased in a steel housing, is connected to a high-temperature fan of 13,000 cfm capacity, forcing the products of combustion through ducts discharging at floor level along both sides of the oven. The circulated hot gases are drawn out through ceiling ducts and about 70 per cent again go through the combustion chamber and are recirculated.

Prefabricated double wall sections, consisting of 5-in. thick glass wool insulation covered by 14 gage steel sheets, make up the oven walls and ceilings, and reduce firing time to 65 per cent of the mold drying time. The drying time cycle is completely automatic and in addition to the many safety protection devices, there is a delayed time firing device whereby the ovens are completely purged of any residual gases before the combustion chamber is ignited. The units were designed, fabricated and installed by



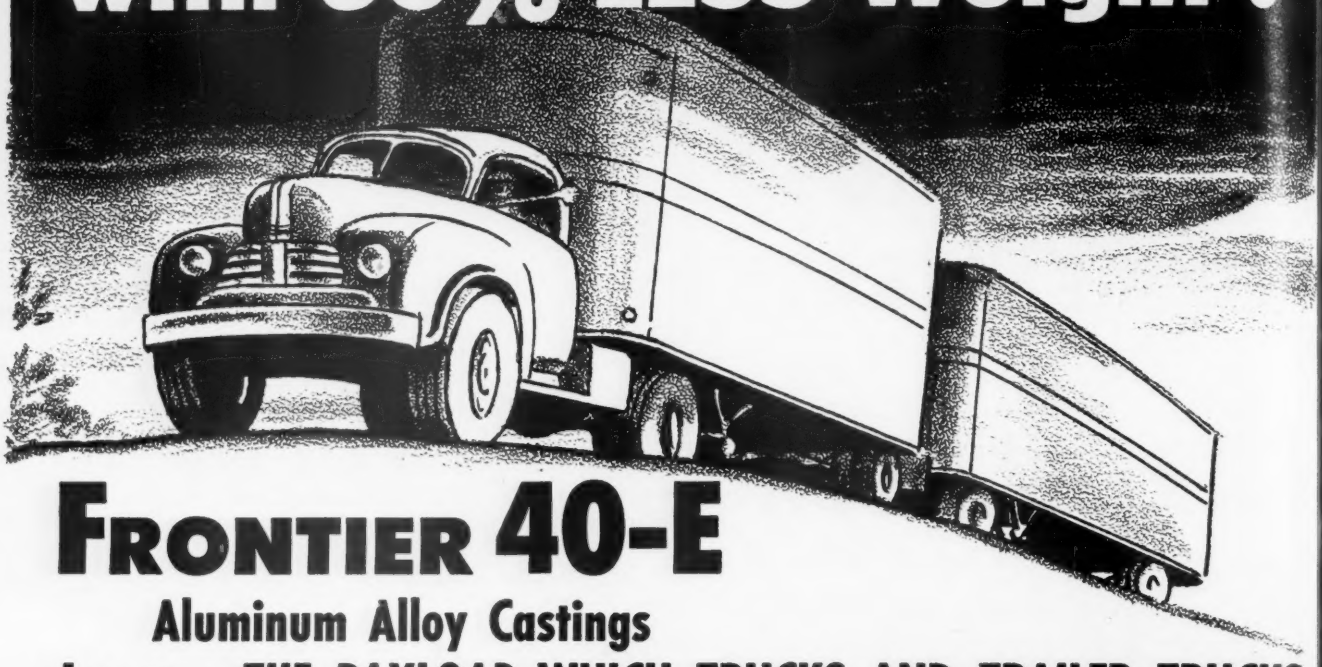


The Carl-Mayer Corp.

3030 Euclid Ave., Cleveland, Ohio

Over thirty years' experience in building all types of Core and Mold Ovens.

You Get the STRENGTH with 60% LESS Weight !

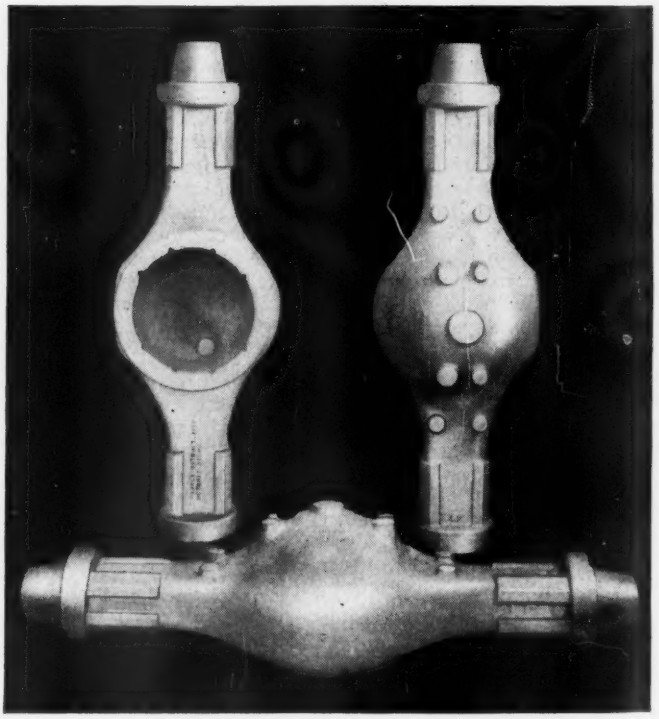


FRONTIER 40-E

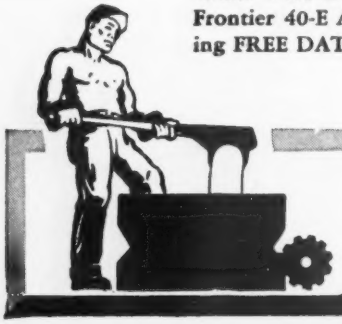
Aluminum Alloy Castings *Increase THE PAYLOAD* WHICH TRUCKS AND TRAILER TRUCKS CAN CARRY

● When FRONTIER 40-E castings, made of non-heat-treated aluminum alloy, are used in tractors, converter gears and trailers, you get 5,000 POUNDS EXTRA PAYLOAD capacity. The special high-strength, light weight qualities of FRONTIER 40-E make it possible for trucks to carry loads that are heavier than would be possible with ordinary tractor, converter gear, and trailer parts. This means extra revenue earned by companies using FRONTIER 40-E. The special properties of this outstanding aluminum alloy are applicable to hundreds of other industrial and commercial fields. Better machineability, greater resistance to shock and corrosion, and test bar uniformity throughout large castings make for more efficient production, greater earning power. You are assured these important features with FRONTIER 40-E.

Write TODAY for full details about Frontier 40-E Aluminum Alloy, including FREE DATA BOOK.



FRONTIER 40-E TRUCK AXLE HOUSINGS



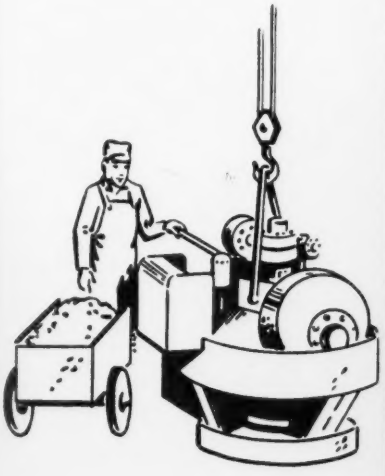
FRONTIER BRONZE CORPORATION

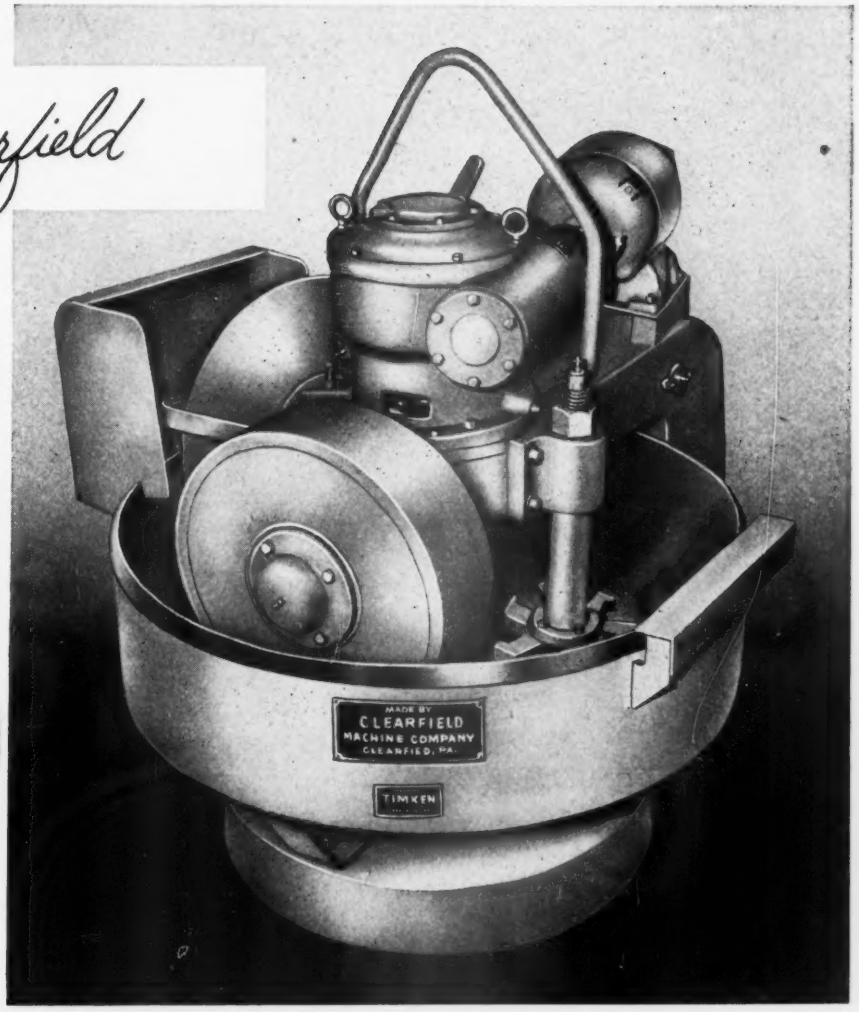
4878 PACKARD ROAD, NIAGARA FALLS, NEW YORK

for *Portability*

THE *Clearfield*

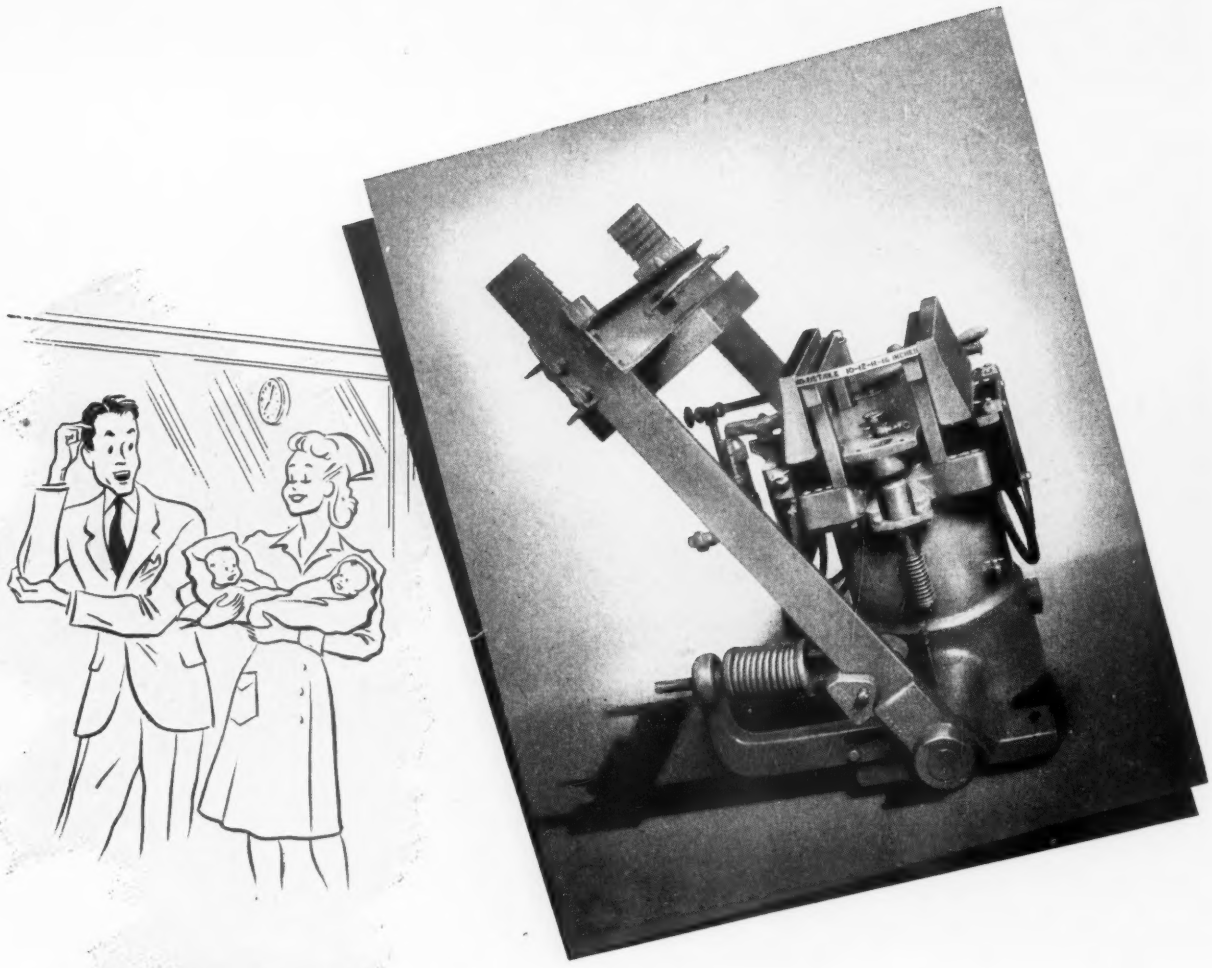
No. 414





This 414 Clearfield Mixer has a wide field of use in either large or small plants in which the plan of sand preparation is built around the portability of the mixing unit. It may be suspended from a crane or monorail hoist and may be thus carried over the entire molding floor eliminating the need for conveying equipment. The machine is perfectly balanced and may be loaded, operated and discharged while suspended above the floor. Where crane facilities are not available for this purpose, the mixer may be equipped with roller bearing casters by means of which it may be moved anywhere over a level floor. The 414 delivers four cubic feet per batch.

CLEARFIELD
MACHINE COMPANY
CLEARFIELD
PENNSYLVANIA, U. S. A



IT DELIVERS WHAT FOUNDRYMEN EXPECT

QUALITY molds and more of them—long life—low upkeep—flexibility that puts the machine "at home" in either production or jobbing shop . . . that's the story with this Tabor Yoke-type Jar-squeeze Flask-lift machine.

Design is the answer! Pattern plate supports and flask-lift sides keep a proper relation between pattern plate and flask surfaces. This means a "sand seal" when the mold is closed. Finning is eliminated . . . savings result.

Tolerances are so close that the match on the castings will depend only on the alignment of patterns.

In addition to its high-production features, this machine is flexible. Its 13"cylinder delivers a uniform squeeze—a smooth 4" draw. Adjustable open-end frame takes pattern plates 10" to 16" wide, at lengths limited only by the 260 sq. in. plate area. Also available with column- or cantilever-type head.

Write today for Bulletin #451 describing this worthy member of the Tabor family—a line of molding machines and allied foundry equipment built to *deliver* what foundrymen *expect.*

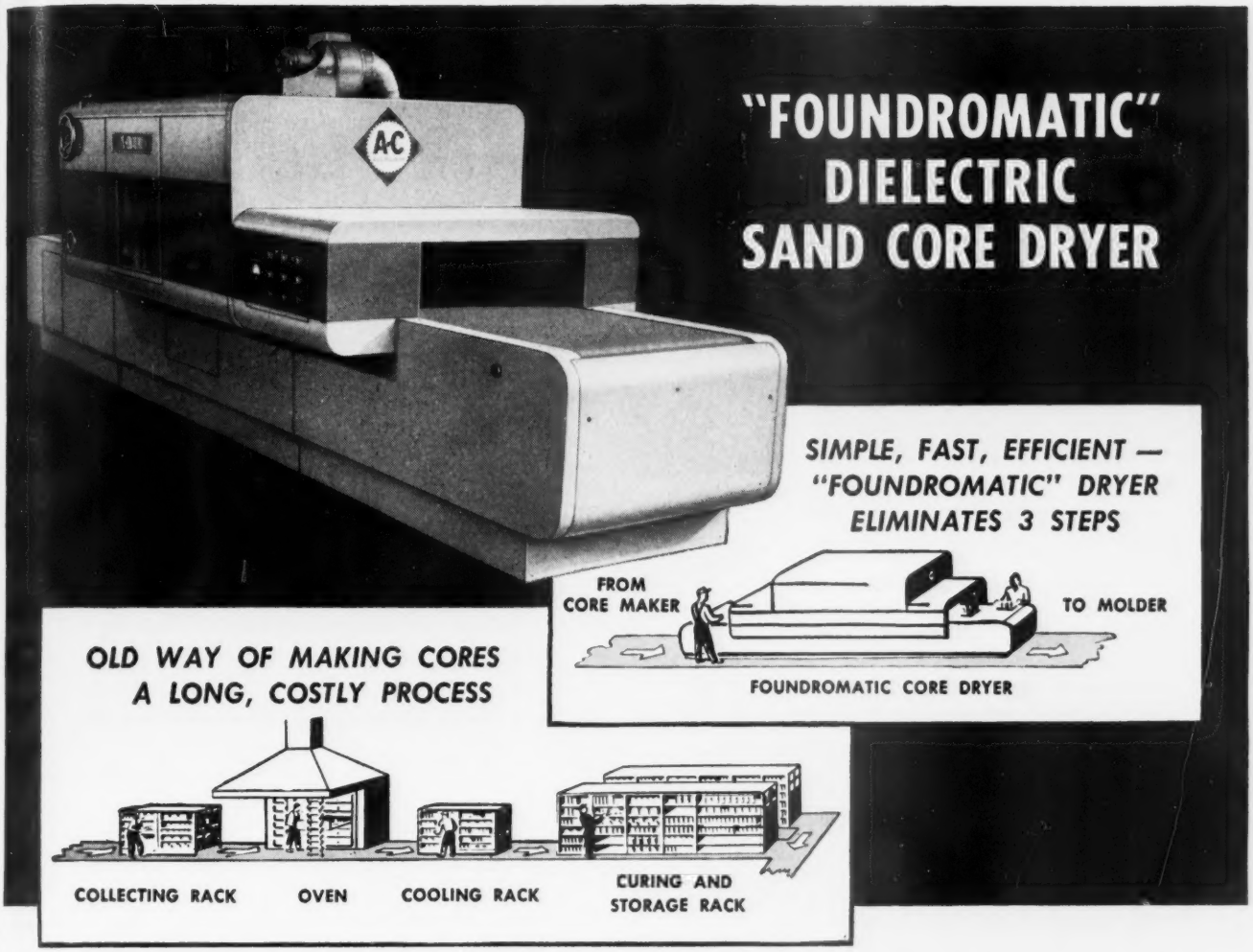
REPRESENTATIVES
Snyder Foundry Supply Company, Los Angeles, Calif.; The Pacific Graphite Company, Inc., 40th & Linden Sts., Oakland 8, Calif.; Carl F. Miller & Company, Seattle, Washington; Harry H. Reich, Trussville, Ala.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

The TABOR Manufacturing Co.

SINCE 1884 MANUFACTURERS OF FOUNDRY MOLDING MACHINES
6225 TACONY STREET • PHILADELPHIA 35, PENNA.

EXPORT DEPARTMENT, 765 DREXEL BLDG., PHILA. 6, PA.



NOW CORE MAKING TIME CAN BE CUT

...from Days to Minutes!

YOU ELIMINATE these three costly steps from core making by using the *Foundromatic* Sand Core Dryer:

1. Eliminate collecting racks. Cores are placed by the coremaker directly onto the moving conveyor belt of the *Foundromatic* Sand Core Dryer.
2. Eliminate cooling racks. When cores come out of dryer, they're cool, dry, ready-to-use.
3. Eliminate curing and storage racks. Cores can be made as needed in a matter of minutes without building up stocks for the next day or week.

In addition there are big fuel savings of 30% to 80% . . . Overbaking of cores is impossible . . . Burning of fins or thin section is ended . . . Working conditions are improved too, because fumes and heat are eliminated from the core room.

Any core that will pass through an aperture 36 inches wide and 13 inches high can be dried in the *Foundromatic* Sand Core Dryer. For details, call your nearby Allis-Chalmers Sales Office.

Foundromatic is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Allis-Chalmers
Milwaukee 1, Wis.

Please send information on the *Foundromatic* Sand Core Dryer.

Name .....

Title .....

Company .....

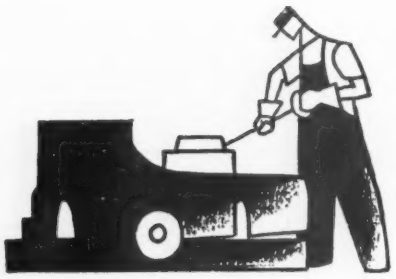
City ..... State .....

A-3246

BETTER CASTINGS AND LOWER SCRAP LOSSES W

NOW ON THE JOB AT GENERAL ELECTRIC RI

The stator frame casting shown here is an important member of the line of castings turned out by General Electric at its River Works Foundry in West Lynn, Mass. This stator frame must be cast with an almost perfect finish and maximum detail, yet a reasonable cost must be maintained. SAND-MEX is added to the molding sand at the River Works Foundry and helps produce top-quality frame castings. SAND-MEX will help you cut scrap losses and turn out better castings. Why not get all the facts about SAND-MEX, the ideal sand conditioner.



- **SAND-MEX** gives better flowability and makes castings truer to pattern.
- **SAND-MEX** helps eliminate surface defects . . . saves time and money in the cleaning room.
- **SAND-MEX** enables sand to run freer in the hopper and chute . . . speeds molding time.
- **SAND-MEX** assures better collapsibility with less dust at shakeout.
- **SAND-MEX** mixes readily with other ingredients in the sand without extra mulling . . . gives equally good results in natural bonded or synthetic sands.
- **SAND-MEX** is permanent, does not burn out . . . only new sand is treated.

We invite you to consult us regarding your molding sand and casting problems. The facilities of our new, greatly enlarged laboratories are at your disposal. Our experienced engineering staff can make recommendations that will save time and money in your operations. Write us today for the full story on SAND-MEX *and other Mexican Graphite products for your foundry.*

THE UNITED STATES

WITH SAND-MEX

RIVER WORKS FOUNDRY

CAST WITHOUT SAND-MEX—General Electric stator frame casting, weighing 86 pounds. This frame was cast from molding sand that did not contain SAND-MEX. Note the generally rough appearance and the burned-in areas.

CAST WITH SAND-MEX—Another stator frame casting made from the same pattern. In this casting, 1% SAND-MEX was used in the molding sand. The obvious difference between the two castings tells the SAND-MEX story.

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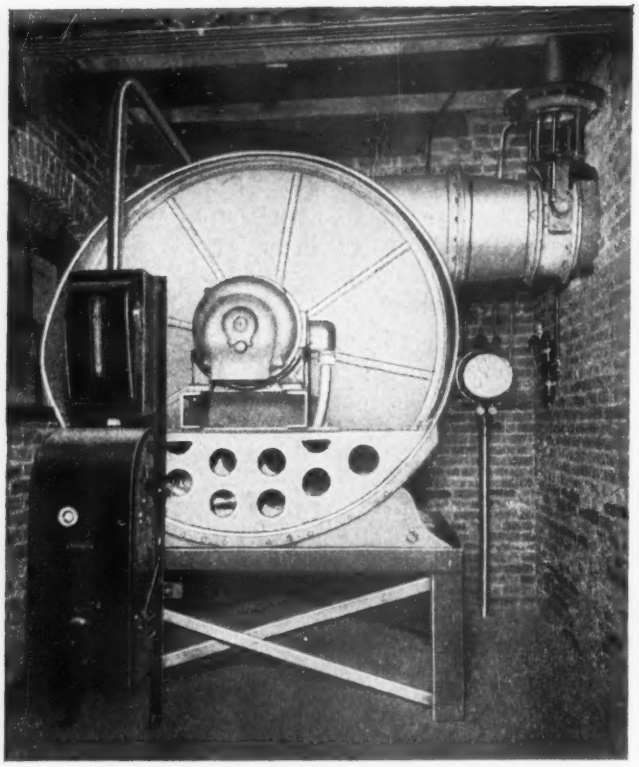
GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN



SPENCER
HARTFORD

IN THE FOUNDRY

The first Spencer Turbo was installed on a cupola in Pittsburgh more than forty years ago, and is still giving satisfactory performance.

As foundry practice improved and became more exacting, the advantages of the Spencer Turbo for foundries became more and more important. Its very simplicity and freedom from shut downs and maintenance for instance became most valuable during the war years when foundries were working at top speed 24 hours a day.

The Spencer Turbo has wide clearances, with only two bearings to grease. It operates quietly, at low speeds and with little vibration. No special foundations are required.

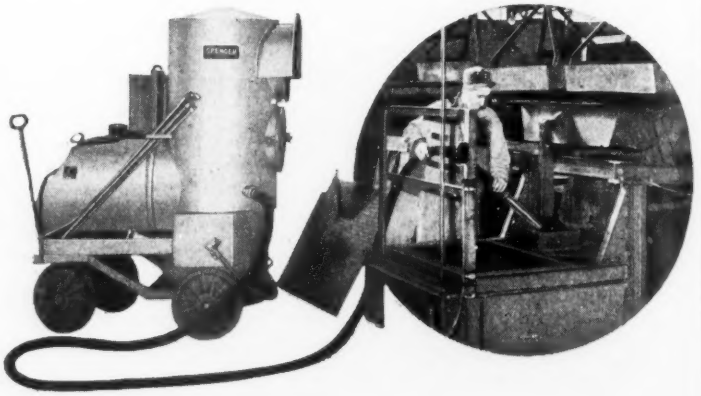
Positive Control: Spencer Turbos deliver a constant pressure of air regardless of cupola loading conditions. Manual control consisting of a calibrated ammeter and a blast gate is standard. Automatic air-weight control with chart readings can be added where required. Ask for the Spencer Foundry Bulletin No. 112.

A Mechanized Foundry Benefits Everyone

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

GOOD HOUSEKEEPING

Spencer Portable Vacuum Cleaners from 1½ to 7½ horsepower are used extensively in foundries to remove overhead dirt and dust and to clean molds, patterns and finished castings. The same machine can be used in other parts of the plant for general housekeeping, or for reclaiming metals, material handling and a hundred other uses along the production line. Bulletins on request.



THE SPENCER TURBINE COMPANY • HARTFORD 6, CONNECTICUT

SPENCER
HARTFORD

414A

FOUNDRY News Report

Dec. 21, 1950

FERROUS FOUNDRIES IN NPA: A. J. McDonald, vice president, American Steel Foundries, Chicago, has been named chief of the Iron and Steel Castings Section of the National Production Authority Iron and Steel Division. While at press time Mr. McDonald had not been assigned permanent quarters, he can be reached at Room 3814A, Department of Commerce Building, telephone Sterling 9200, extension 2951. The Iron and Steel Castings Section probably will be enlarged shortly to include separate units devoted to the three ferrous castings branches, and those specialties important to the war effort.

NFA IN WASHINGTON: National Foundry Association has opened a Washington office at Suite 35, Rust Building, 1001 Fifteenth St., N. W. Fred A. Hartley, former congressman, will be in charge.

EQUIPMENT AND SUPPLIES: Representatives of the Foundry Equipment Manufacturers' Association and the Foundry Facing Manufacturers' Association have been working with representatives of NPA to establish an advisory committee and representative in the NPA organization. Another meeting in Washington is planned for early in January.

INDUSTRY SURVEYS: Mobilization plan for the malleable castings industry (*FOUNDRY* November, 1950, p. 100) which was prepared under the direction of the Malleable Iron Castings Subcommittee of the Munitions Board, is finding good use by various agencies planning future foundry needs. The steel castings industry study, prepared under direction of the Steel Castings Subcommittee, is being tabulated and should be available shortly. Studies of gray iron and the nonferrous branches are under consideration, although the agency to handle the job has not been designated .

WHO HANDLES WHAT: There may be new names, faces and room numbers tomorrow, but at press time the following NPA people were handling casting problems in the products listed:

LIGHT METALS: Hubert L. Cullen, Room 2239 Tempo T, Sterling 9200, extension 3530.

COPPER: L. C. Chew, Room 3067 Commerce, Sterling 9200, extension 3943.

ZINC: Harry B. Vogel, 3087 Commerce, Sterling 9200, extension 3929.

TIN: William L. Raup Jr., 3316 Commerce, Sterling 9200, extension 3952.

MACHINERY: Marshall M. Smith, chief, Room 2134 Tempo T, Sterling 9200, extension 4550, William L. Beck, deputy chief, 2134 Tempo T, Sterling 9200, extension 2629.

MACHINE TOOLS: P. L. Houser, chief; Herbert L. Tigges, advisor, Room 2131 Tempo T, Sterling 9200, extension 3463.

PIG IRON: J. A. Claussen, 3814A Commerce, Sterling 9200, extension 2951.

SCRAP: Marvin Plant, 3814A Commerce, Sterling 9200, extension 2951.

REFRACTORIES: Marguerite Sauers, 3814A Commerce, Sterling 9200, extension 2951.

NONFERROUS MAKES PROGRESS: Representatives of the Non-Ferrous Founders' Society met in Washington, Dec. 13-14, with men from the Economic Stabilization Authority and the NPA. As a result of their discussions, it seems probable that certain revisions may be provided for order M 12 on copper, and that in the near future the NPA will have foundrymen handling foundry problems in both light metals and copper-base alloys.

PIG IRON CONTROLS: Contrary to some newspaper reports, the NPA claims no present intention of ordering curtailment in civilian consumption of pig iron. The pig iron situation is tight and is being watched closely by NPA. If pig iron imports continue at anything near the all-time October level of 139,061 short tons, the need for controls will be that much less.

CAR BUILDERS BUSIER: Heavy tonnages of castings will be needed this year by freight car builders. Cars on order Dec. 1 totaled 126,870; a year ago the figure was 14,146. A typical freight car truck requires about 2100 pounds of cast steel for side frames and bolster, 85 pounds of cast iron for brake shoes and 2800 to 3000 pounds for the chilled iron wheels.

ALUMINUM CLIMBING: Production of primary aluminum is at a six-year peak and will go higher now that the government has ordered reactivation of reduction equipment that was idled by lack of economical electric power. Necessary high-cost power will be made available for the emergency. Some new capacity also will be added. Primary aluminum production topped 62,000 tons monthly in the fourth quarter last year.

AND SO IS MAGNESIUM: Capacity for producing primary magnesium shortly will be increased about five-fold—to 240 million pounds annually—by reactivation of six standby plants. Castings currently account for slightly less than 30 per cent of total magnesium consumption. At the recent annual meeting of the Magnesium Association it was estimated that production of nodular cast iron will require 5 to 10 million pounds of magnesium annually.

PIGS STAY HOME: Southern foundries now are using about 95 per cent of the output of southern foundry pig iron. At the beginning of the century over 90 per cent of this iron was shipped to foundries of the North and East. Bradford C. Colcord, president, Woodward Iron Co., Woodward, Ala., recently told the American Iron and Steel Institute at Birmingham that this trend reflects the large expansion which has occurred in the foundry industry of the Southeast.

PRICES STILL RISE: December saw a broad upward trend in prices of foundry raw materials. In addition to a general $3 increase in pig iron, coke was raised 60 cents to $1 at a number of centers and scrap was markedly stronger. Increases also were made in ferrochrome, ferrosilicon, silicon briquets and nickel products.

PRICES OF FOUNDRY METALS AND COKE . . .

(As of Dec. 21, 1950)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE	
Connellsville	$17.00-18.00
New River	19.50
Wise County	15.95
OVEN	
Birmingham	$20.30
Chicago	21.00
Detroit	24.00
Erie, Pa.	23.50
Everett, Mass.	24.80
Indianapolis	22.75
Kearney, N. J.	22.75
Milwaukee	23.75
Painesville, O.	24.00
Philadelphia	22.70
Pittsburgh	23.00
Portsmouth, O.	21.50
St. Louis	24.25
Swedeland, Pa.	22.00
Terre Haute, Ind.	22.50

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Bethlehem, Pa.	$54.50	$55.00
Birmingham	48.88	....
Buffalo	52.50	53.00
Chicago	52.50	52.50
Cleveland	52.50	52.50
Everett, Mass.	52.25	52.75
Fontana, Calif.	58.50	....
Geneva, Utah	52.50	....
Granite City, Ill.	54.40	54.90
Lone Star, Tex.	48.50	48.50
Pittsburgh	52.50	52.50
Steelton, Pa.	54.50	55.00
Swedeland, Pa.	56.50	57.00
Toledo, O.	52.50	52.50
Troy, N. Y.	54.50	55.00
Youngstown, O.	52.50	52.50

NONFERROUS INGOTS

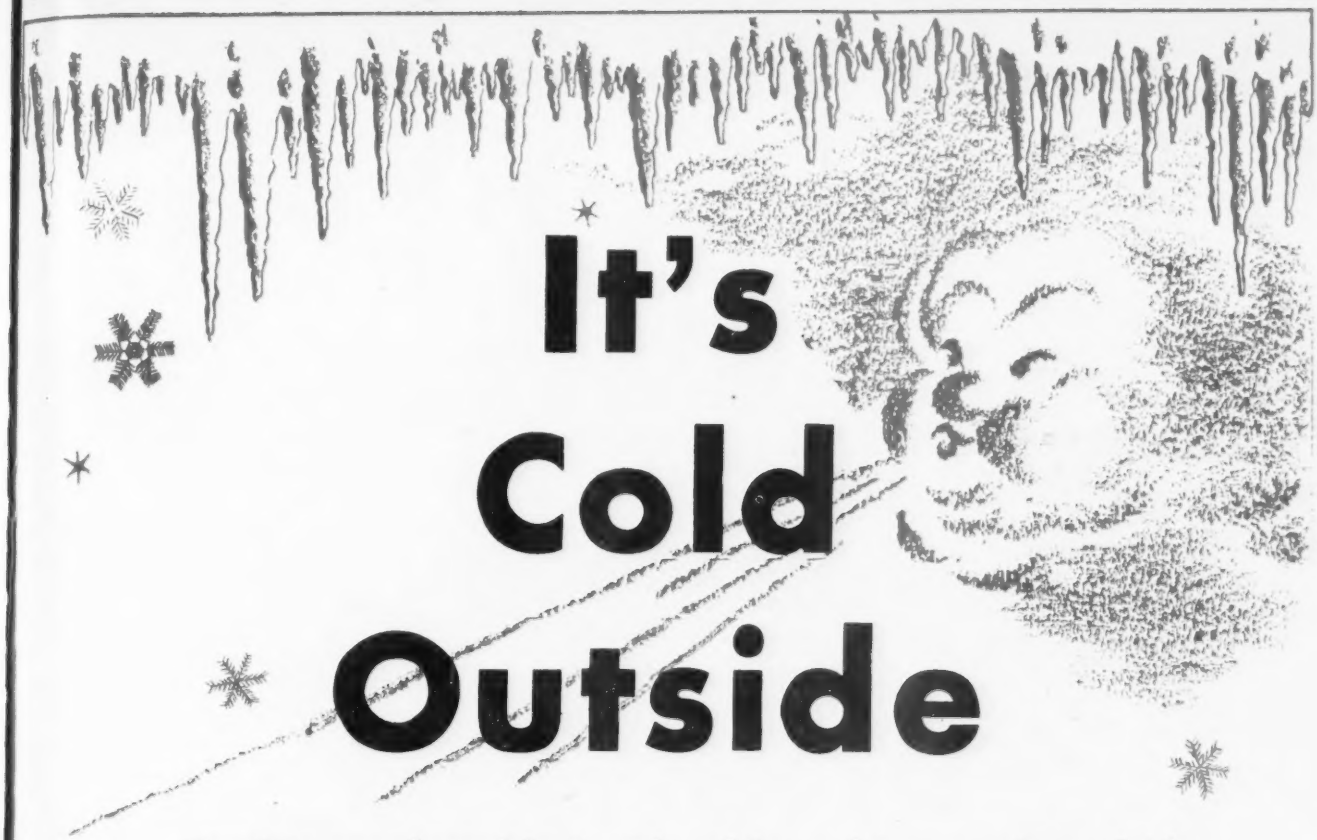
BRASS AND BRONZE: 85-5-5-5—29.00c; 88-10-2—44.50c; 80-10-10—35.00c; No. 1 yellow—25.50c. **ALUMINUM:** 99 per cent plus, primary ingots 19.00c. Secondary No. 12 alloy 30.50-31.00c. **MAGNESIUM:** 99.8 per cent standard ingots 24.50c, f.o.b. Freeport, Tex.

IRON AND STEEL SCRAP

(Consumer prices per gross ton, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Stove Plate	Heavy Breakable Cast	Low Phos., Electric Furnace	Malleable	Short Steel Rails
Birmingham	$43.50	$59.00-60.00	$54.00-55.00	.....	.....	.....	$65.00-66.00
Boston*	35.67	44.00-46.00	42.00-43.00	41.00-42.00	44.50-45.00	.....	.....
Buffalo	44.50-45.25	52.00-53.00	.....	.....	48.25-49.00	60.00-61.00	60.00-61.00
Chicago	45.00	62.00-64.00	49.00-50.00	.....	52.00-54.00	73.00-75.00	66.00-68.00
Cincinnati	46.00	70.00	55.00	56.00	62.00	84.00	72.50
Cleveland	45.50-46.00	65.00-66.00	55.00-56.00	55.00-56.00	48.00-48.50	72.00-73.00	71.00-72.00
Detroit*	40.25-41.25	59.00-61.00	.....	49.00-51.50	42.75-47.00	.....	.....
Los Angeles	30.00	43.00-48.00	.....	.....	40.00	.....	.....
New York*	39.00	47.00-48.00	.....	44.00-45.00	41.50	.....	.....
Philadelphia	45.00	54.00-55.00	.....	54.00-55.00	51.00	74.00	66.00-67.00
San Francisco	30.00	46.00	.....	.....	45.00	.....	.....
St. Louis	46.00-48.00	60.00-62.00	49.00-50.00	56.00-58.00	.....	70.00-72.00	63.00-64.00

*Brokers' buying prices



It's Cold Outside

But it's comfortable inside of foundries equipped with Schneible Compensating Air Uni-flo Ventilation Hoods that reduce the exhaust of warm air from the building up to 75%. Save your valuable warm plant air and save money.

CLAUDE B. SCHNEIBLE COMPANY
P. O. BOX 502, ROOSEVELT ANNEX
DETROIT 32, MICHIGAN

Please send me your new bulletin 450 without obligation.

Name_____ Title_____

Company_____

Address_____

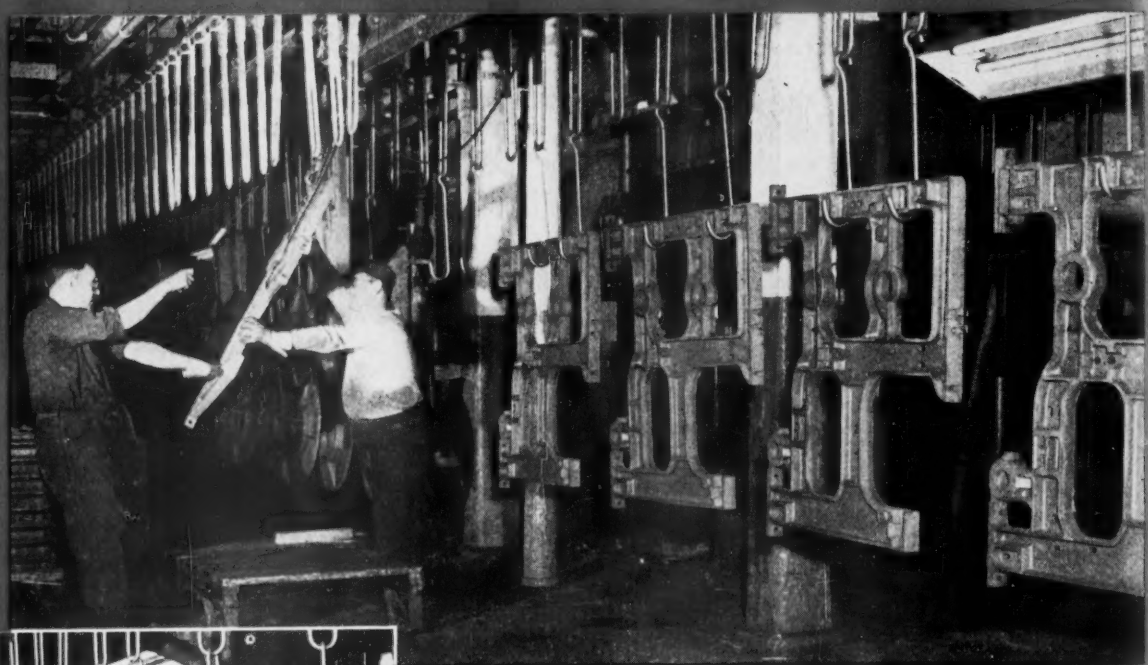
City_____ Zone_____ State_____

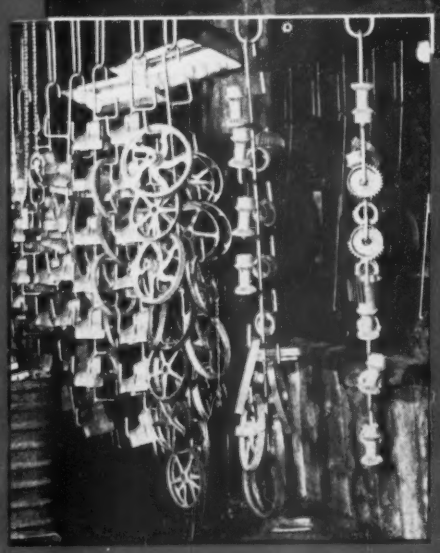
SCHNEIBLE

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

AT CROMPTON and KNOWLES LOOM WORKS

WHEELABRATOR®





5 Bonus Benefits

1. Orderly and efficient flow of material.
2. Eliminated use of costly compressed air.
3. Improved finish appearance.
4. Decreased space requirements.
5. Better working conditions — noise and dust eliminated.

American

WORLD'S LARGEST BUILDER

slashes cleaning time 95%

saves 32 man hours daily

replaced 7 cleaning machines

saved $50,000 in new equipment

Wheelabrator's high speed cleaning performance made itself felt in a hurry when Crompton & Knowles Loom Works replaced seven machines with a Wheelabrator Cabinet for cleaning gray iron textile loom castings. The one Wheelabrator provided the cleaning speed and capacity needed to keep pace with production requirements where two tumbling mills, three airblast tables and two rooms had been inadequate before.

At the same time cleaning room personnel was reduced from eight to four men and working conditions for these men were much improved. At least $50,000 worth of new equipment would have been required for extending the former equipment to meet higher production requirements.

In addition, a superior job of cleaning is accomplished in much less time. For example, the Wheelabrator cleans 100 loomsides, shown in the large picture at the left, in 2½ hours. Tumbling mills, formerly used, required 13 hours per load of 20 to 22 of these castings.

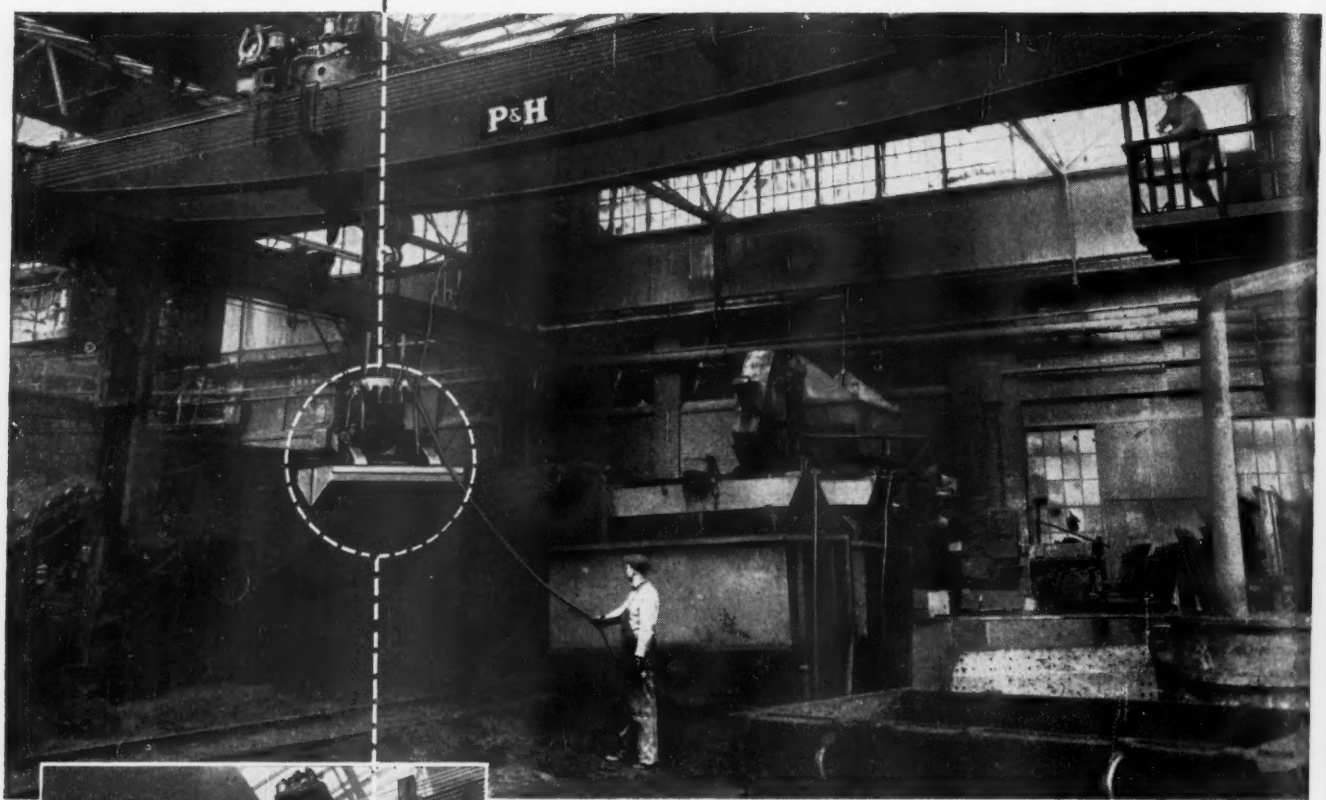
Greater production, less maintenance, lower operating costs, better cleaning quality, lower costs per ton—these are vital points in which the Wheelabrator excels—and the reasons why modern cleaning rooms depend upon Wheelabrators for profitable production. Write for full information today on how you, too, can use a Wheelabrator profitably.

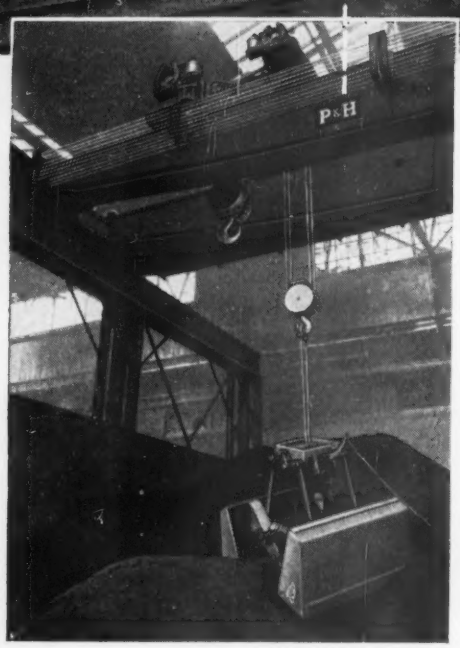
WHEELABRATOR & EQUIPMENT CORP.

505 S. Byrkit St., Mishawaka 2, Indiana

MFR. OF AIRLESS BLAST EQUIPMENT

P&H SINGLE LINE GRAB BUCKETS





a *"Natural"* in foundry service!

In a matter of seconds you can attach the P&H Single Line Grab Bucket to your crane hook and it's ready to go to work. It's as simple as that — and it provides easy, accurate one-man operation. It works fast, bites deep, picks up clean.

Here's the fast, easy way to handle all kinds of bulk materials — sand, coke, crushed stone, cinders, etc. It's widely used to unload cars, dig pits, fill flasks, etc. A "natural" for foundry use if there ever was one.

Available in capacities from ½ to 2½ yds. Write for all the facts about it. Ask for Bulletin C-27.

P&H

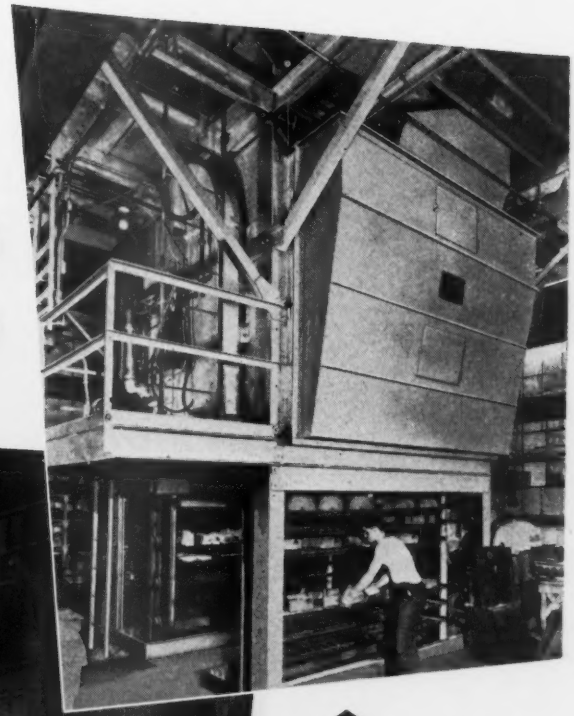
GRAB BUCKETS
4405 West National Avenue
Milwaukee 14, Wis.

HARNISCHFEGER CORPORATION
ELECTRIC CRANES · EXCAVATORS · ARC WELDERS · P&H · HOISTS · WELDING ELECTRODES · MOTORS

COLEMAN CORE AND MOLD OVENS

provide

maximum production
better work conditions
lowest operating cost



Coleman Tower® Oven at Monroe Steel Castings Co.

Coleman double-end Car Type Oven at the Birdsboro Steel Foundry & Machine Co.

Throughout the foundry industry, Coleman Core and Mold Ovens are recognized for providing maximum production, better work conditions and lowest costs. Only in Coleman Ovens can you be sure of securing all these advantages:

PERFECT BAKING AND DRYING—eliminating rejects and make-overs.

LOWEST LABOR COST—by utilizing the most efficient handling methods for your production requirements.

MAXIMUM FUEL SAVINGS—using the fuel most economically available to you.

POSITIVE VENTILATION—preventing leakage of fumes and gases and assures better work conditions.

MOST ADVANTAGEOUS USE OF AVAILABLE FLOOR SPACE—through efficient mechanical design.

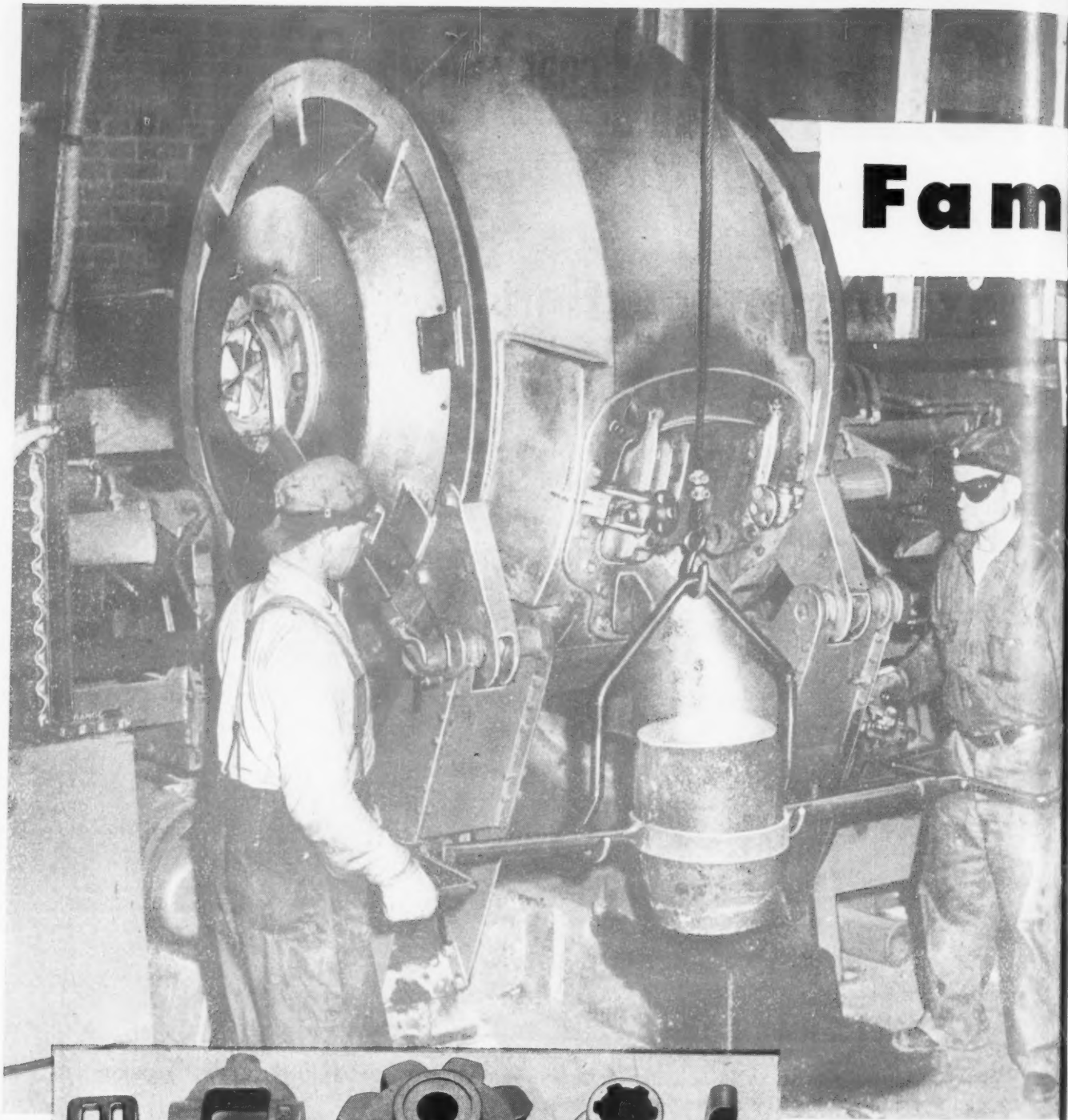
FLEXIBILITY AND ACCURATE CONTROL—to bake oil or resin binders—whichever is most satisfactory for your casting requirements.

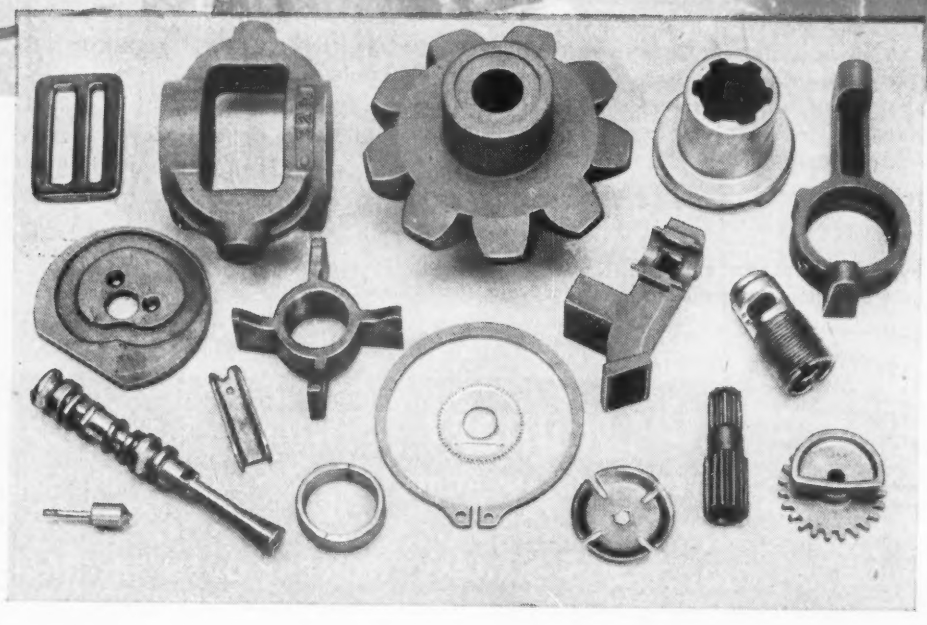
For further information write today for Bulletin 48

A COMPLETE RANGE OF TYPES:
COLEMAN OVENS are built in a complete range of sizes and capacities for every core-baking and mold drying requirement: Tower Ovens, Horizontal Conveyor Ovens, Car-Type Ovens, Transrack Ovens, Rolling Drawer Ovens, Portable Core Ovens, Portable Mold Dryers, etc.

THE FOUNDRY EQUIPMENT COMPANY
1831 COLUMBUS ROAD — CLEVELAND 13, OHIO
MEMBER FEMA

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS





▲ Tapping a heat of beryllium copper from one of five Detroit Electric Furnaces at The Beryllium Corp.

◀ Representative castings of beryllium copper, produced at The Beryllium Corporation.

y of Eight!

The Beryllium Corporation melts all of its beryllium copper alloys in Detroit ROCKING electric furnaces

Beryllium copper alloys, produced by The Beryllium Corporation, are gaining an expanding place in industrial usage because of their special combinations of useful properties. All eight alloys in Beryllium Corporation's family are melted in Detroit Rocking Electric Furnaces.

Accurate Control

Accurate temperature control is one of the important advantages these furnaces deliver. Through melt after melt, the desired melting cycle is followed, resulting in fastest, most efficient operation.

The rocking action of the furnace during the melt always assures homogeneity. Minimum metal loss allows a high degree of control over alloy composition.

Metal for castings is poured directly from the furnace into pig molds of various sizes. Detroit Rocking Electric Furnaces are also used for producing ingots, too.

Favorites in many Foundries

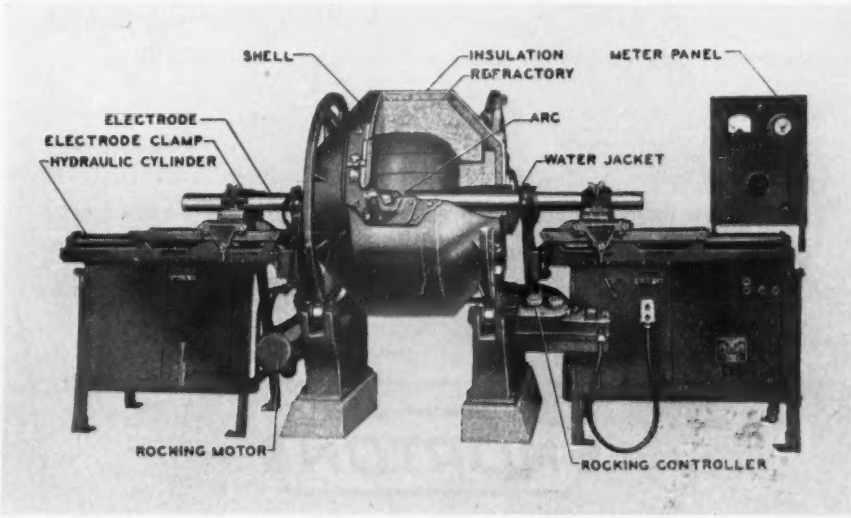
The same qualities which make them so efficient at Beryllium Corporation work as well at hundreds of foundries throughout the world.

Positive control of composition and quality, reduced metal shrinkage, more efficient use of power, no carbon pick-up because electrodes remain clear of the molten metal, more heats per day, higher quality castings, fewer rejected castings, more usable metal per melt, less out-of-production time because of easy shell replacement—these are some of the advantages Detroit Electric Furnaces offer in ferrous and non-ferrous melting.

Furnaces (10 to 4000 lbs. capacity) are individually designed to meet your plant electrical specifications.

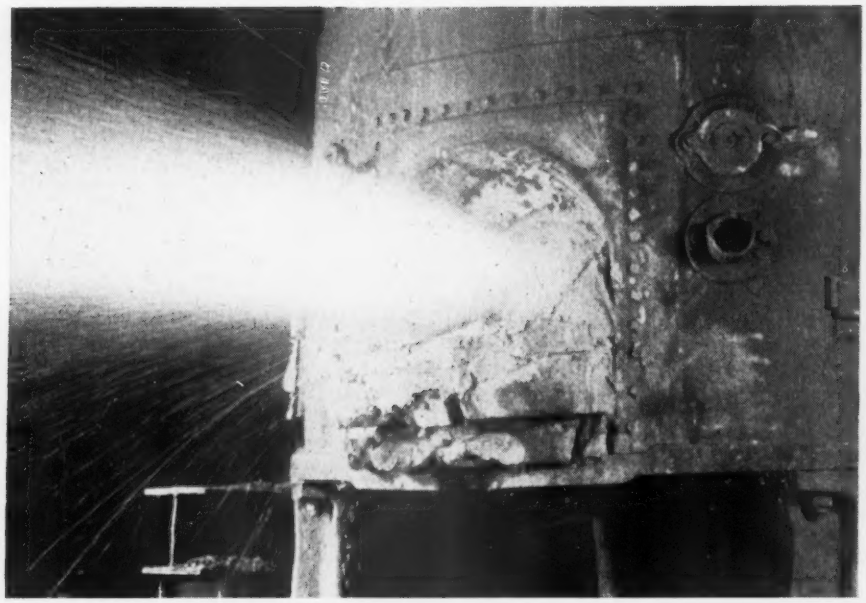
Write for Facts

Send us your production data. Ask for facts on high operating economy, quality control and other advantages for *you* in Detroit Rocking Electric Furnaces!



ELECTRIC FURNACE DIVISION

Kuhlman Electric Company • Bay City, Michigan



SLAG HOLE BLOCKS LAST LONGER when made of Norton Crystolon* Refractory because the more dense bonded silicon carbide grain resists slag action either by corrosion or erosion.

NO SOFTENING OR SPALLING AT TEMPERATURES UP TO 3050°F!

That's one big advantage you get when you use Norton Crystolon* slag hole blocks in your back-slagging cupolas. Made of densely bonded, chemically inert silicon carbide grain, they resist the corrosion, erosion and penetration of slag 5 to 15 times longer than fire clay blocks.

Give yourself this *extra* assurance of getting all the way through your campaign without stopping to replace your slag hole block.

Compare!

Yes, compare Norton Crystolon slag hole blocks with whatever you're now using. Chances are you, too, will get longer runs before replacement. For prices or more information, contact your nearby Norton representative or write us direct. NORTON COMPANY, WORCESTER 6, MASS.

NORTON

TRADE MARK REG. U. S. PAT. OFF.

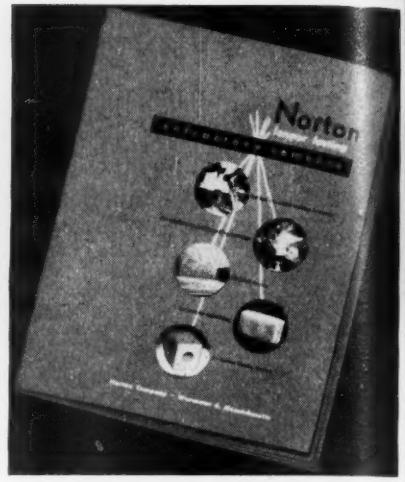
Making better products to make other products better

Special REFRACTORIES

Canadian Representative

A. P. GREEN FIRE BRICK CO., Ltd. TORONTO, ONTARIO

Up-To-The-Minute Facts About Refractory Cements



"The most helpful bulletin on refractory cements ever published"

That's the opinion of the foundry and furnace men who have read this new Norton bulletin. Compiled after exhaustive laboratory and field tests by Norton refractory engineers, this bulletin covers the entire subject of Norton cements with charts, drawings and detailed instructions.

Selection charts

If this bulletin contained nothing but its two selection charts, it would be well worth sending for. At a glance, you know the right cement for various metal-melting furnaces, for brick laying, for resistor imbedding, for burner blocks and tunnels.

"How To" Instructions

Other subjects covered by this booklet include correct preparation, proper installation, drying and maturing . . . all the do's and don'ts that add up to longer-lasting cement applications.

Write for bulletin 863

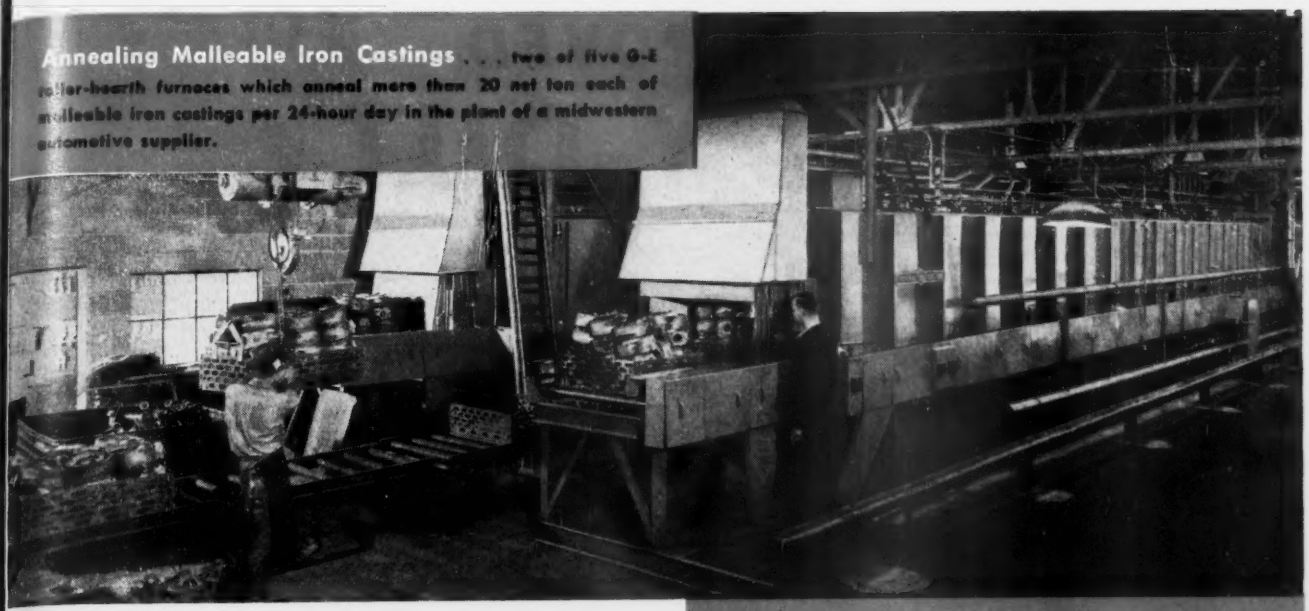
NORTON COMPANY

301 NEW BOND STREET

WORCESTER 6, MASS.

* Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

Annealing Malleable Iron Castings . . . two of five G-E roller-hearth furnaces which anneal more than 20 net ton each of malleable iron castings per 24-hour day in the plant of a midwestern automotive supplier.



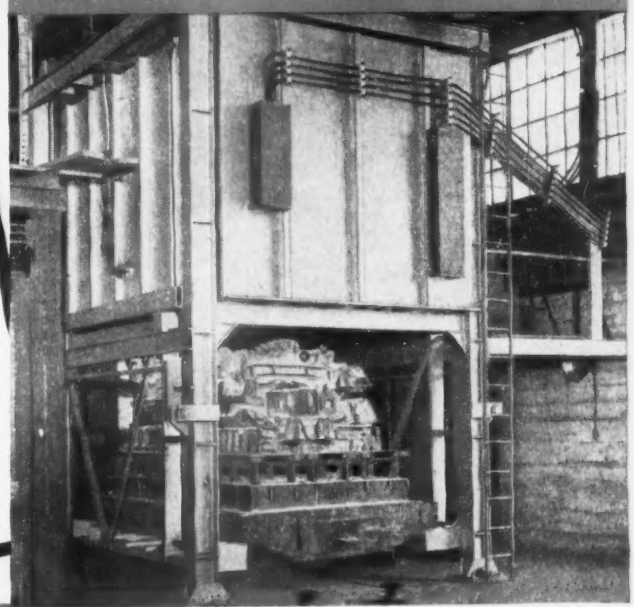
Do It Better Electrically

Electric Furnaces

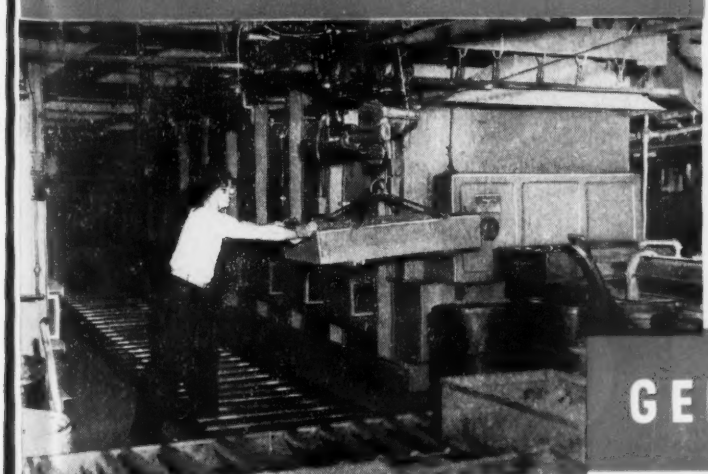
In addition to a shorter time cycle and increased output, they also give you:

Lower over-all cost
More uniform, better quality anneal
Materially reduced cleaning costs
Minimized thermal losses
Cleaner, cooler working conditions
Dependable continuity of service with less maintenance
Less floor space required

Annealing Steel Castings . . . one G-E elevator furnace anneals 10 tons of steel castings per charge in this southern foundry.



Annealing Grey Iron Castings . . . two pusher-type G-E furnaces anneal 30 tons of grey iron castings per day in this eastern plant.



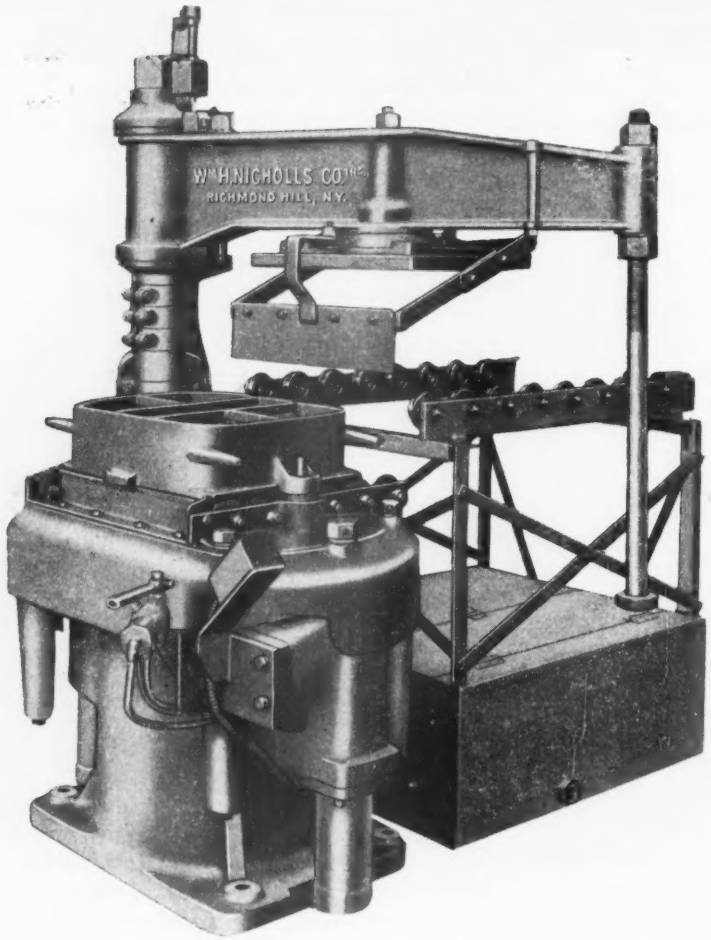
Tell us about your annealing job, and we'll show you what General Electric furnaces can do for your particular operation. G-E furnaces and electronic induction heaters are also available in a variety of types and ratings for brazing, hardening, drawing, soldering, carburizing, and most other heat-treating processes. Ask your nearest G-E office to put you in touch with a G-E Industrial Heating Specialist. Or write direct to ***Sect. 720-25, Apparatus Department, General Electric Company, Schenectady 5, N. Y.***

GENERAL ELECTRIC

720-25

IMPROVED
HEAVY-DUTY MOLDING MACHINES

COMBINATION JOLT & POWER SQUEEZERS WITH PNEUMATIC PATTERN DRAW AND POWER OPERATED, PARALLEL, SELF POSITIONING SQUEEZE HEAD, AND EQUIPPED WITH ELECTRICAL CONTROLS FOR SINGLE BUTTON AUTOMATIC OPERATION



14-36 TYPE "D"

Heavy Duty Combination Jolt & Power Squeezer Molding Machine with pneumatic pattern draw and power operated self positioning parallel squeeze head. Equipped with electrical controls for single button automatic operation of Jolt, Squeeze, Pattern Draw and Cross-arm. Including Automatic Sand Strike-off, Mold Pusher & Adjustable Flask Rolloff Device.

Also larger size machines now equipped with electrical controls for automatic operation. Nicholls builds a complete line of Molding Machines comprising stationary and portable types for the production of light, medium and heavy castings. Descriptive literature available for each type.

Wm. H. NICHOLLS Co., Inc.
RICHMOND HILL, LONG ISLAND, NEW YORK

Foreign Manufacturers and Selling Agents—
For Continental Europe and Great Britain—The George Fischer Steel and Iron Works, Schaffhausen, Switzerland

NICHOLLS

Model CH-20 Truscon Power Handled Flask.

Model CH-40 Truscon Flask for Extra Heavy Duty.

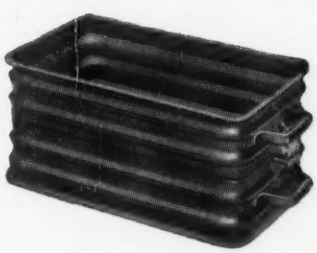
HEADQUARTERS
FOR STEEL FOUNDRY FLASKS

THE SUCCESS of modern foundry methods depends upon the speed and economy with which molding operations can be handled.

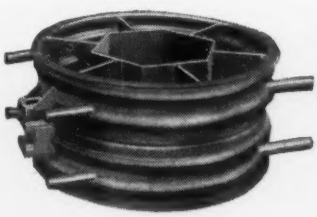
Truscon's Pressed Steel Division — nationally known for the quality of its products and the dependability of its service — is fully equipped and prepared to handle your foundry flask requirements. The Pressed Steel Division's central location assures efficient service for your needs. Write for free catalog describing the complete line of Truscon Steel Foundry Flasks.

TRUSCON
STEEL COMPANY
PRESSED STEEL DIVISION
6100 TRUSCON AVE. • CLEVELAND 4, OHIO
Subsidiary of Republic Steel Corporation

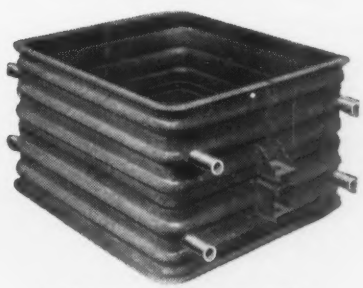
Model OM-1 Truscon Flask for One-Man Handling.



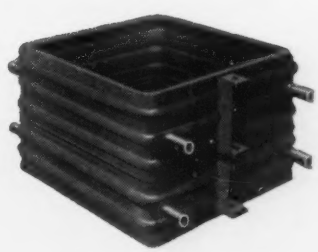
Model OM-4 Truscon Flask for One-Man Handling.



Model TMR-60 Round Truscon Steel Flask for Two-Man Handling.



Model TM-10 Truscon Flask for Two-Man Handling.



Model TM-12 Truscon Flask for Two-Man Handling.

Powder-Cutting

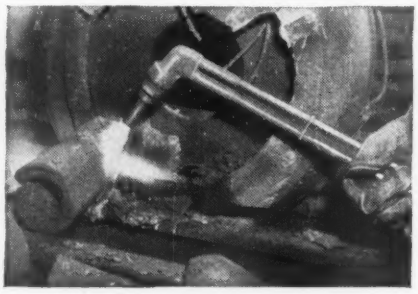
Steps Up Production of Stainless Steel Castings 32 Times . . .

Centrifugally-cast rings of stainless steel are cut in 15 minutes time, increasing production 32 times.

Riser cutting of centrifugally-cast stainless steel rings used to be a difficult and time-consuming job. In one foundry which used a boring machine, this operation took eight hours per casting. When powder-cutting was introduced, the time was reduced to approximately 15 minutes—a 32-fold increase in production.

In another foundry, powder-cutting was profitably used to remove $\frac{3}{8}$ to 1 in. of metal from stainless steel castings. The machining cost for this type of work has been $24.00 per casting. Substitution of powder-cutting brought the overall cost, including finish-grinding and chipping, to $7.53 per casting, and reduced the time from 8 hours to 1 hour. For an order of 60 castings, the foundry saved $988.20 and 360 hours of operating time.

If you have stainless steel or other oxidation-resistant metals to cut, LINDE's service engineers can show you how powder-cutting methods can be used with profit. Phone or write the nearest LINDE office.



Here, risers on stainless steel castings are being powder-cut—a time saving of 30 per cent over the former methods.

Linde
Trade-Mark

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

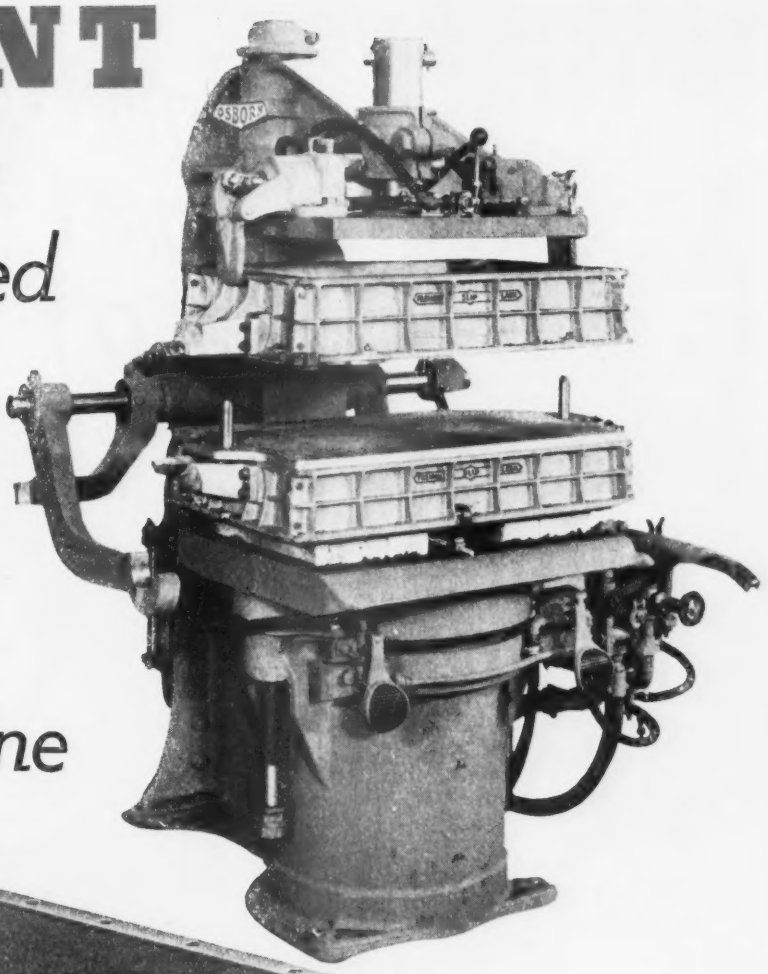
30 East 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

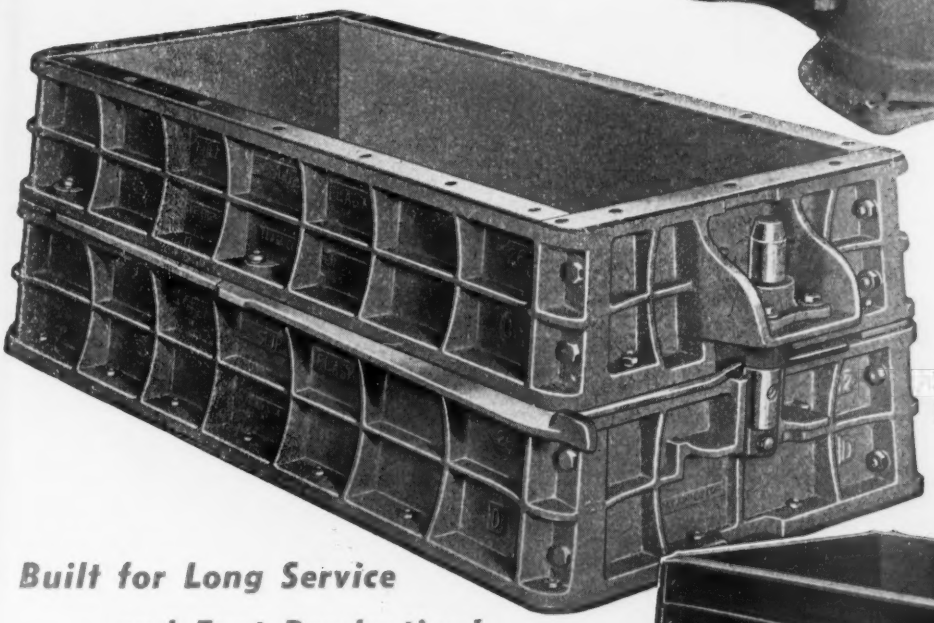
In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

The word "Linde" is a registered trade-mark of The Linde Air Products Company

FREMONT FLASKS

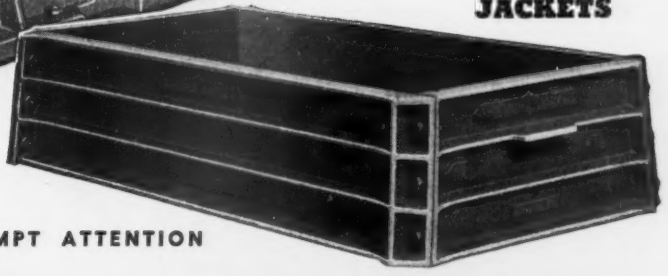
are ideally suited to help speed production with the Osborn Rota-Lift Molding Machine





FREMONT MAGNESIUM FLASKS

FREMONT CAST IRON JACKETS



Built for Long Service and Fast Production!

ALL ORDERS GIVEN PROMPT ATTENTION

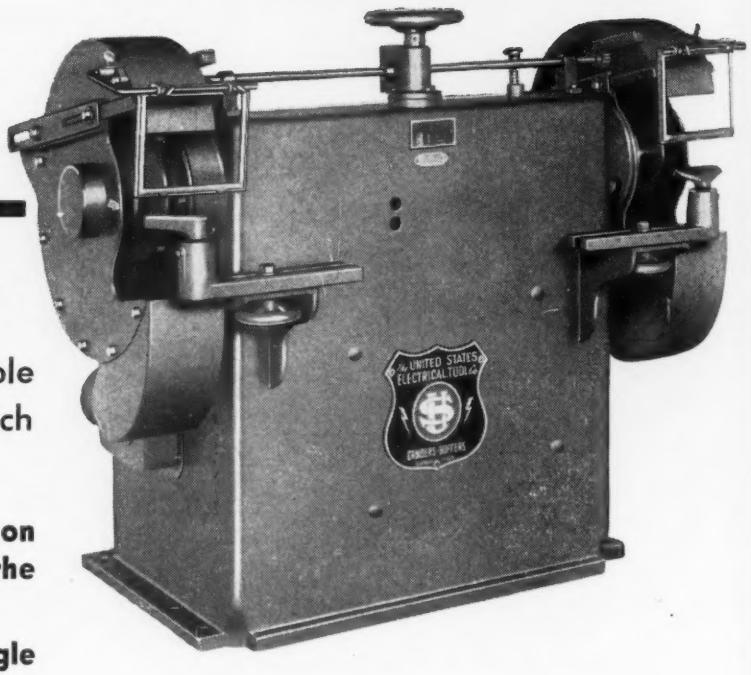
GROOVLOCK
THE FOOL-PROOF PIN

THE FREMONT FLASK CO.
Fremont, Ohio

IF-you are PRODUCTION minded
IF-you are ECONOMY minded
IF-you are QUALITY minded

Positively LOWEST COST in time and labor

UNITED STATES ELECTRICAL *VARI-SPEED* SNAGGING GRINDERS



Model 64 VS

One of the leaders in the remarkable family of snagging grinders which assures you

- **constant peripheral speed on the grinding surface of the wheels throughout their life**
- **practically same cost as single speed grinders**
- **adjustable wheel guards which govern wheel speed**
- **infinitely variable speeds**

available with one or two motors; for wheels up to 24 inches

Contact your jobber... get full details NOW

The UNITED STATES ELECTRICAL TOOL Co.
CINCINNATI, OHIO

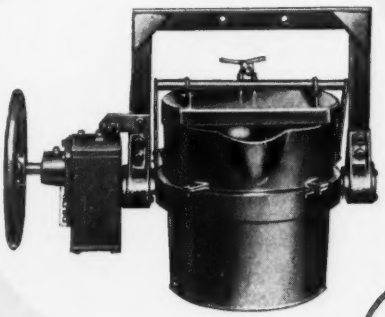
LET WHITING'S ENGINEERING HELP SOLVE YOUR LADLE PROBLEMS

RIVETED CRANE LADLES

Would you like to have ladles that are safer to use, easier to handle, easier to pour, and longer lasting under the hard use of day-after-day foundry service?

Whiting ladles have met those specifications for over 60 years, supplying the industry with quality ladles that handle hot metal with the greatest possible convenience and economy.

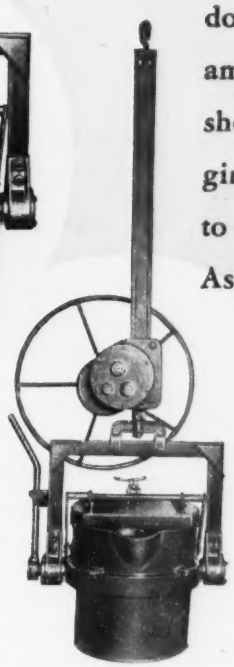
COVERED TROLLEY LADLES



Whiting supplies ladles of every type . . . if you do not find exactly what you need among the 200 styles and sizes shown in the Bulletin, Whiting Engineers can design and build ladles to meet your special requirements. Ask for information.

Bulletin FY-163 sent on request

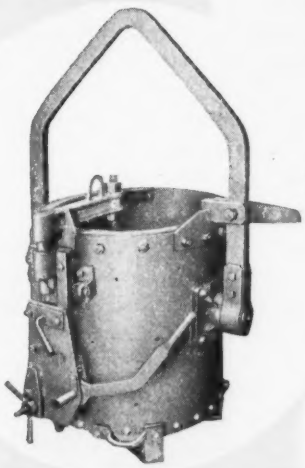
LADLE HANDLERS



WHITING CORPORATION

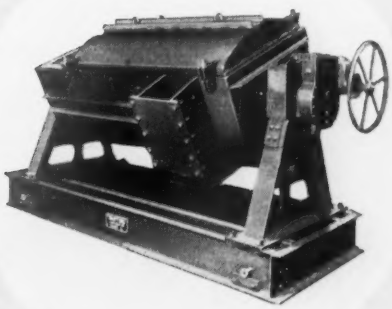
15607 Lathrop Ave. Harvey, Illinois

Offices in Chicago, Cincinnati, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, and St. Louis. Representatives in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church St., New York 7, N. Y.



BOTTOM TAP LADLES

OUTSIDE TEAPOT SPOUT LADLES



U-LADLES

Constructed to Take Severe Punishment

Without Tube Swelling

CONCORD #20 STEAM HOSE

Here's the steam hose with a structural difference that eliminates . . . once and for all . . . the common failure of tube swelling under continuous high pressure operation.

CONCORD #20 Steam Hose gives you the exclusive protection of a tough inner lining . . . a lining of stainless steel wire braid. This braid assures permanent retention of the original inside hose diameter. It prevents swelling and constriction of the tube . . . assures full flow of steam at all times . . . permits re-coupling in the field when necessary, without the slightest difficulty.

In addition, CONCORD #20 construction features include: two or three braids (depending on size) of alternate high tensile steel wire and rubber layers are firmly bonded over the outside of the tube. They provide maximum burst-protection and safety. An asbestos braid provides positive cover adhesion and serves as cover insulator. On top of all is the rugged, abrasion-resistant cover that withstands the severest abuse.

Flexible, tough and dependable . . . that's BWH's new CONCORD #20! Ask your nearby BWH distributor for a demonstration. Get in touch with him today, or write us direct.

Tube Securely Locked by Special Stainless Steel Inner Wire Braid!

Illustration above shows how exclusive inner stainless steel braid of CONCORD #20 Steam Hose prevents tube swelling and assures long life under severe use.

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

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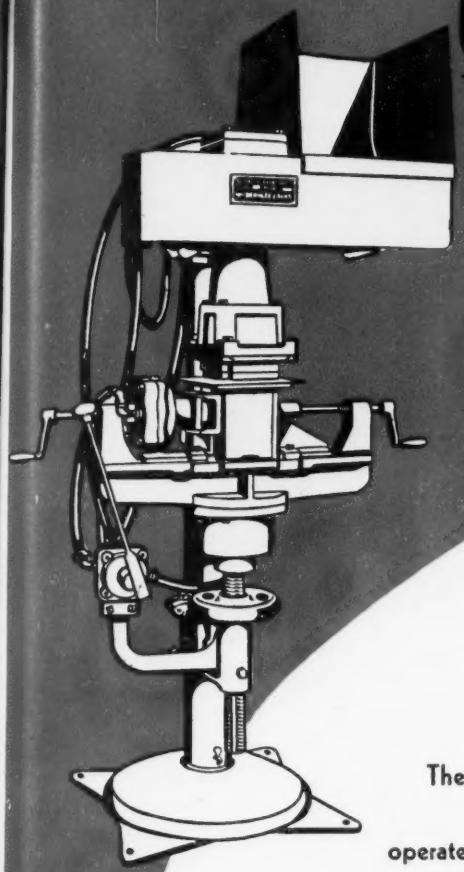
DEPENDABLE RUGGEDNESS

GREATER PROFITS FOR YOU

DEMMLER
CORE BLOWERS



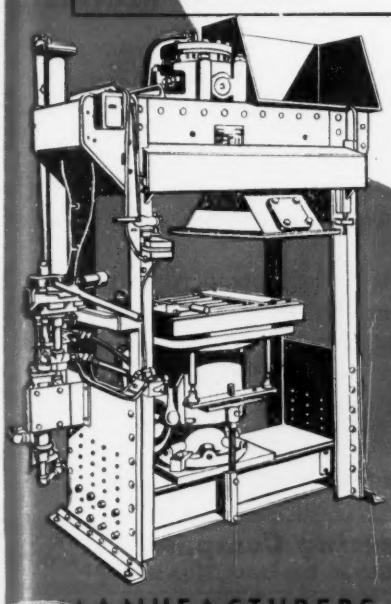
No. 55 CORE BLOWER IS A PROVEN MONEY MAKER

You, too, can boost your profit margin through increased production of high quality small cores. The DEMMLER No. 55 small core blower is ideal for short run jobs—a proven money maker in foundries of every size.

A quality machine throughout, the DEMMLER No. 55 can be counted upon for years of dependable service.

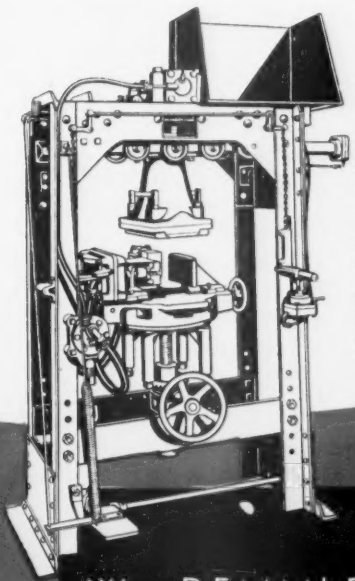
The No. 55 will blow cores weighing up to four pounds, will accommodate boxes nine inches long. Machine has both vertical and horizontal air operated core box clamps, automatically controlled by the same valve that blows the core. Simple in construction and operation, the DEMMLER No. 55 core blower represents one of the greatest values . . . one of the soundest investments in the core blowing field today

Free illustrated specification sheets on any of the three DEMMLER Core Blowers shown will be sent on request.



DEMMLER No. 2E

For use on cores which can be blown to advantage by attaching top half of core box to blow plate and drawing core on machine. Draws of extreme accuracy assured.



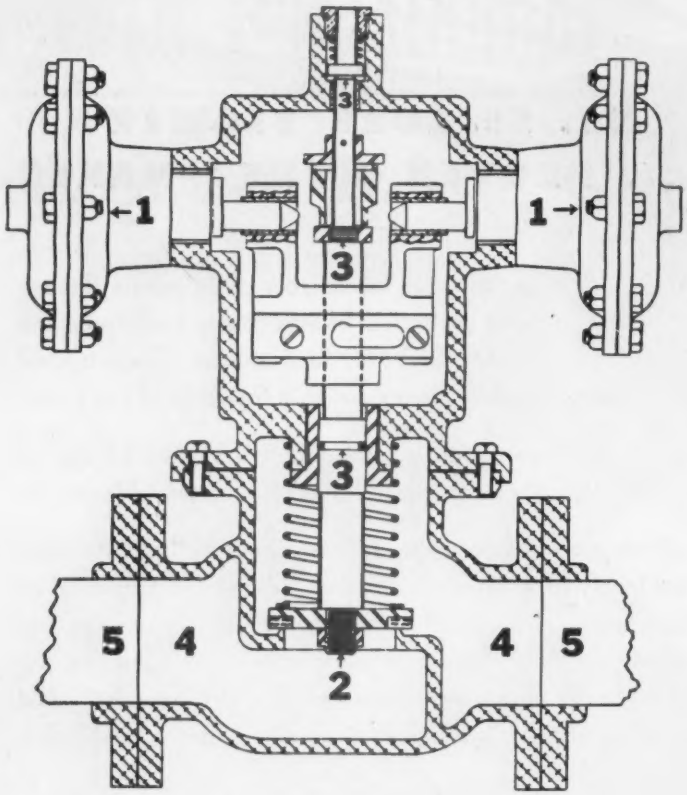
DEMMLER No. 1

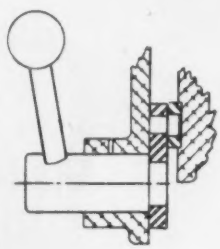
Here's a truly versatile, general purpose core blower. Blows cores up to eight pounds in weight, has quick job changing features, one of the best known, and liked, machines in the field.

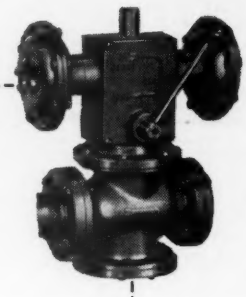
Wm. DEMMLER & BROS.
KEWANEE, ILLINOIS

MANUFACTURERS OF CORE BLOWERS EXCLUSIVELY SINCE 1911

here's the "INSIDE STORY"







Why NEW SERIES "LT"

McKee Eclipse **LOCK-TITE** *Safety Valve*

is able to give

The Most Complete Protection

NO OTHER VALVE on the market so completely fulfills the latest safety requirements for a positive, manual reset, safety shut-off valve as the new series "LT" McKee-Eclipse LOCK-TITE Safety Valve. Some of the reasons are listed here.

For the complete story of this revolutionary development write today for Free, Illustrated Bulletin M-302, describing operation and construction in detail, and including valve selection and other engineering data.

1. **MOST VERSATILE**—Only LOCK-TITE offers positive shut-off in case of Eelectric, Gas or Air Failure or a Combination of any two of these by the use of interchangeable power units.
2. **MOST POSITIVE SHUT-OFF**—LOCK-TITE has positive soft-seat seal—75 PSI seating pressure.
3. **EXCLUSIVE THROUGH-SHAFT CONSTRUCTION**—with special guide bushings—eliminates wedging and binding.
4. **PROPERLY DESIGNED VALVE BODY**—gives full pipe size areas throughout entire flow pattern, for minimum pressure drop.
5. **EASIEST TO MOUNT**—Only LOCK-TITE has all sizes with flange mounting, for quicker, simpler installation.
6. **BETTER MATERIALS FOR LONGER WEAR**—All LOCK-TITE valve castings are pressure-tested 55 aluminum alloy; all materials subject to corrosion are cadmium plated and all subjected to extreme wear are hard chrome plated.

Representatives in all Principal Cities

Y-5375

Eclipse Fuel Engineering Company
725-1 South Main Street, Rockford, Illinois

McKee Eclipse

THE MOST COMPLETE LINE OF GAS-FIRED INDUSTRIAL EQUIPMENT ON THE MARKET

CUT Core Making Time From Days to Minutes!

YOU CAN ELIMINATE the three costly steps shown in the chart at right using the *Foundromatic* Sand Core dryer. This means you no longer need start making cores days or weeks ahead of time unless you want to. With this new unit, cores are ready for the molder immediately after leaving the dryer . . . minutes after leaving the core maker.

SAVE 80% TIME PLUS FUEL

Even figured on the basis of the drying operation alone, you save at least 80% in time. Add to this, fuel savings of 30 to 80% (depending on the type of fuel and binder you are now using) and you begin to see the tremendous advantage of this revolutionary new system.

NO OVERBAKING OF CORES

You eliminate burning of fins or thin sections of cores . . . reduce rejects. Working conditions are improved too. Fumes and heat are eliminated from core room.

Any core that will pass through an aperture 13 in. high and 36 in. wide can be dried by the standard Sand Core dryer.

PROVED IN A-C'S OWN FOUNDRIES

Allis-Chalmers engineers will gladly study your core requirements and recommend proper equipment to fit your production set-up. Their advice is based on several years operation in A-C's own huge foundries. Call your nearby A-C Sales Office, or write direct.

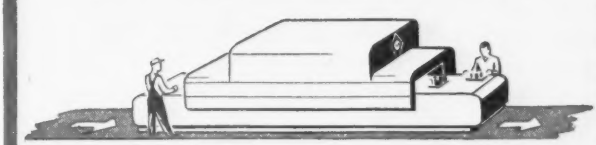
A-2985

ALLIS-CHALMERS, 1032A SO. 70 ST.
MILWAUKEE, WIS.

Foundromatic is an Allis-Chalmers trademark.

OLD WAY

FOUNDROMATIC DRYER WAY



3 STEPS YOU CAN ELIMINATE

Eliminating these 3 steps with the *Foundromatic* Sand Core dryer means you cut core making time from days to minutes.

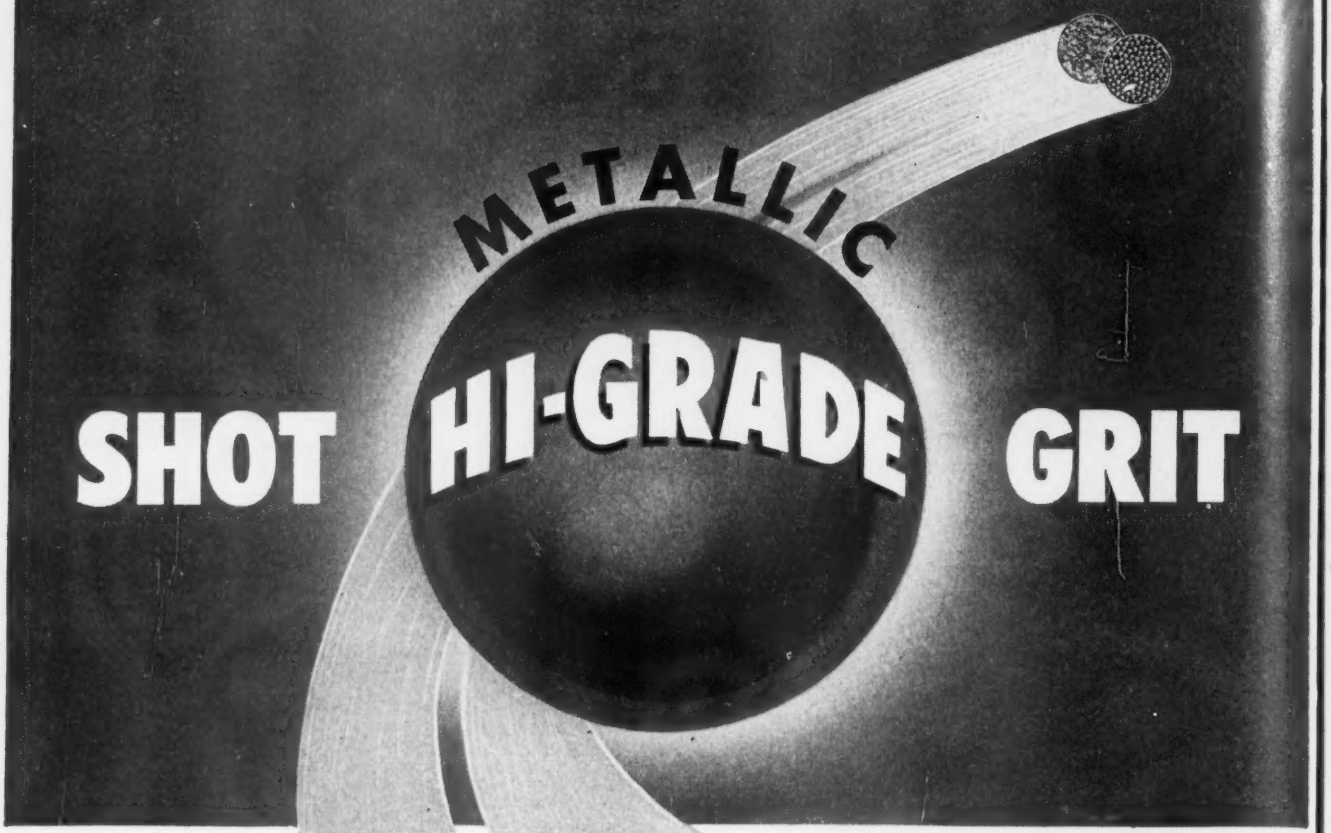
1. Eliminate collecting racks. Cores are placed directly onto the moving conveyor belt of the *Foundromatic* Sand Core dryer.

2. Eliminate cooling racks. When cores come out of dryer, they're cool enough to be handled bare-handed.

3. Eliminate curing and storage racks. Cores can be made as needed in a matter of minutes, without building stocks on curing and storage racks.

ALLIS-CHALMERS

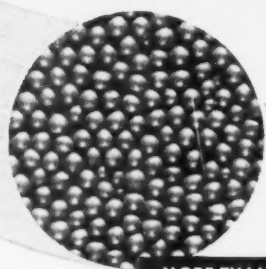
For Uniform, Low Cost, Efficient Blast Cleaning



When you buy shot and grit, you buy a promise of uniform, low cost, efficient blast cleaning or peening. Your confidence in the material ordered should be based on actual use, rather than recommendation or reputation. Its true value to you can only be determined by a thorough test in your equipment, on your job.

To all outward appearances, most shot and grit may appear to be the same—but, that's where the similarity ends. Where Hi-Grade Shot and Grit are concerned, you'll find there IS a difference . . . a value far beyond purchase price that pays out in extra performance on *your* job. Hi-Grade Shot and Grit is *quality-controlled* from molten metal to finished product. Order a trial quantity today. Let results convince you *Hi-Grade is best by test.* That's the only practical and profitable way to buy abrasives.

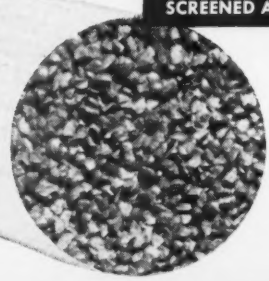
PACKED IN 100 LB. BAGS
READY FOR IMMEDIATE SHIPMENT



HI-GRADE SHOT
UNIFORM SIZE AND HARDNESS

Withstands repeated strain, stress and wear. Famous for its lack of hollows, tails, irregular shapes. Exclusive alloying and tempering process helps prevent rust; minimizes impact fractures.

MORE THAN MEETS S.A.E. SPECIFICATIONS
SCREENED AND GRADED FOR 100% USAGE



HI-GRADE GRIT
SHARP, TOUGH AND DURABLE

Made of same material and processed by same methods as Hi-Grade Shot. Free from dust fines and scale. Cleans with maximum efficiency. Easy on equipment—reduces wear and maintenance costs.

Clayton-Sherman *Abrasives Company*

MANUFACTURERS OF *QUALITY-CONTROLLED* SHOT AND GRIT

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MEETRITE
PIG IRON

LIVING UP TO ITS NAME

MORE USED THAN ANY OTHER MERCHANT PIG IRON

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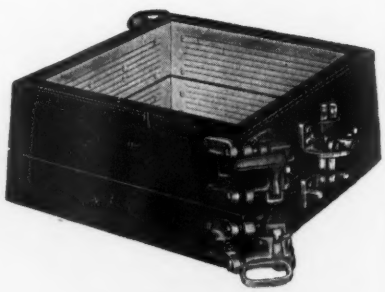
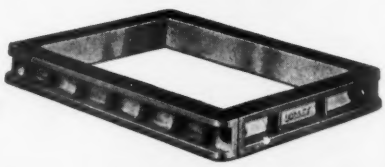
Portable Type

ADAMS

MOLDING MACHINES and CUSTOM-BUILT FLASK EQUIPMENT





HERE are the "Partners" that keep production rolling and costs low . . . help you meet today's increasing competition with *faster* production of *better* castings at lower cost.

Adams Molding Machines are designed by experienced foundrymen to solve your production problems . . . to give you the speed, power and durability for consistently large output day after day. Close control of jolting and squeezing operations means accurate, uniform molds. Smooth, easy operation, with minimum working parts, simplifies operation and maintains steady, high output levels.

Adams Flasks are custom built to your exact specifications for superior performance and economical production.

Get these "Partners" on your production team now! Write for full information. THE ADAMS COMPANY, 700 Foster Street, Dubuque, Iowa.

The ADAMS Company

ESTABLISHED 1883

DUBUQUE, IOWA, U.S.A.

MOLDING MACHINES and FLASK EQUIPMENT

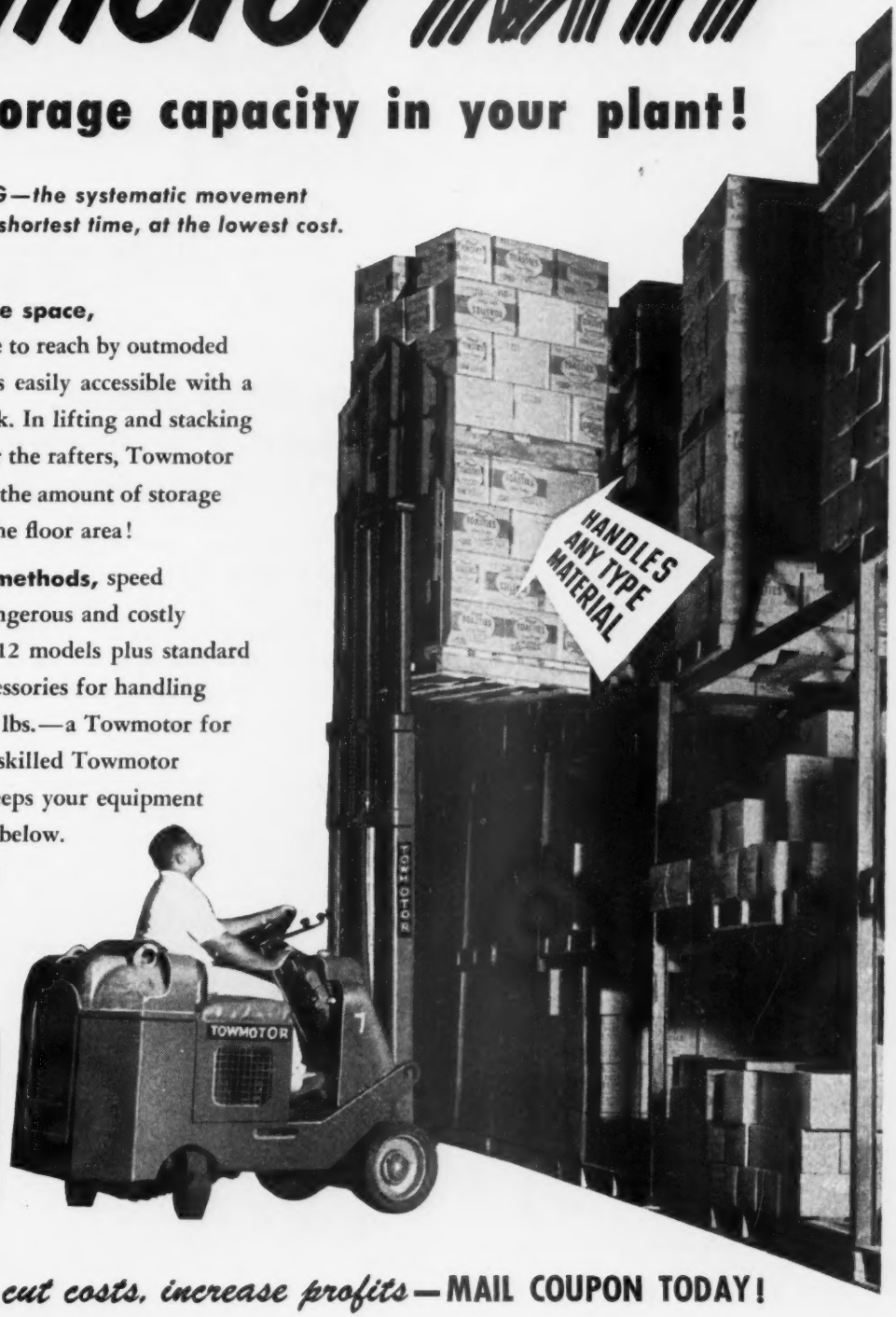
Towmotor MH*

doubles storage capacity in your plant!

***MH IS MASS HANDLING—the systematic movement of the most units, in the shortest time, at the lowest cost.**

Valuable, costly storage space, difficult or even impossible to reach by outmoded manual handling, becomes easily accessible with a Towmotor Fork Lift Truck. In lifting and stacking heavy loads right up under the rafters, Towmotor **M**ass **H**andling can *double* the amount of storage space *without* increasing the floor area!

Improve your storage methods, speed order filling, eliminate dangerous and costly "stock-falls." Select from 12 models plus standard and specially designed accessories for handling loads from 1500 to 15,000 lbs.—a Towmotor for *every* job. And learn how skilled Towmotor Preventive Maintenance keeps your equipment *on* the job—mail coupon below. Towmotor Representatives in all Principal Cities in U. S. and Canada.



See the
TOWMOTOR EXHIBIT
Booths 322-323
1951 MATERIALS HANDLING EXPOSITION
International Amphitheatre
Chicago, April 30—May 4

***See how you can cut costs, increase profits*—MAIL COUPON TODAY!**

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Please send me current issue of "Handling Materials Illustrated" and information on Towmotor Preventive Maintenance.

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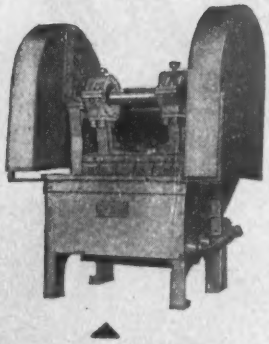
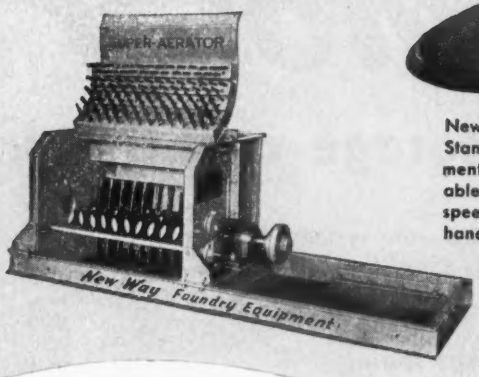


Newaygo Core and Refuge Crusher quickly returns its cost in salvaged material. It also crushes slag for iron reclamation, separates gaggers and rods for re-use.



Newaygo Foundry Turntable — Standard sizes 8' to 24'. Segmental construction. Interchangeable gear sections. Variable speed drive. Underpan with plows handles spillage through grates.

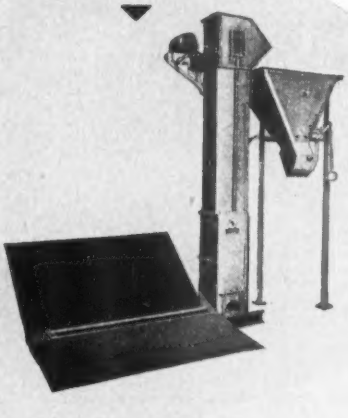
Newaygo Aerator efficiently and economically tempers, cools and blends foundry sand to a uniform consistency. Made in sizes for any sand handling system.

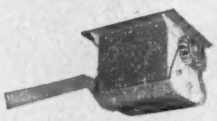
Put your floor space to work More Efficiently with NEWAYGO equipment

You can get more work from every foot of floor space in your foundry with Newaygo equipment that's designed for your specific requirements. A single new machine often increases the overall productivity of your entire foundry. Work flows through each operation at the same high speeds. There is no one machine too big or too small. Every machine is the right size and has the right capacity for the job *you* have to do.

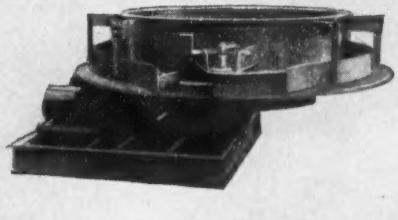
Ask Newaygo Engineers for recommendations that will lower your costs and increase your profits. There's no obligation of course.

The Handy Sandy eliminates hand shoveling for molders and increases their production with this unit, the molder just reaches overhead and the sand drops into flask.





Newaygo Sand Gates—double undercut type. Available for all bins and hoppers. Geared for easy operation. Hand, counterweight or air operated.



Newaygo Rotary Plate Feeder supplies an even, controlled sand volume. Readily attaches to tanks and bins. Two sizes — capacities up to 75 tons per hour.

Newaygo Mill cuts costs for large users of sand. Salvages sand lumps from screens, separates non-magnetic tramp material and metal which escapes magnetic separator. For systems up to 120 tons per hour.

NEWAYGO ENGINEERING COMPANY

NEWAYGO, MICHIGAN

Manufacturers of NeWay Mold Handling, Sand Handling and Conditioning Equipment

Advertisement

ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

SILICON . . . Deoxidizes, Increases Strength, and Improves Electrical Properties of Metals

Silicon is one of the most important elements used in the iron, steel, and non-ferrous industries. It is an efficient low-cost deoxidizer; and in larger amounts, it is also an effective alloying element.

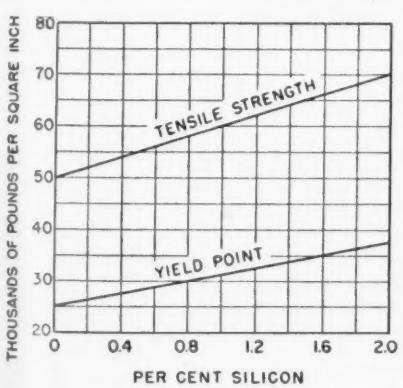
Efficient Deoxidizer

Silicon is used in practically all grades of carbon and alloy steels and offers an economical means of effectively eliminating oxides from the molten bath in all steel-making processes. Amounts up to about 0.80 per cent silicon are used for deoxidizing various steels used for forgings, wrought products, and castings.

Recent published research papers, covering work done in ELECTROMET's laboratories, have added greatly to the knowledge about the deoxidizing power of silicon by itself, and also in conjunction with other elements. Complete information is given in a report entitled "Solubility of Oxygen in Liquid Iron Containing Silicon and Manganese." If you would like a copy of this report, free of charge, write to the address above.

Improves Physical Properties

When used as an alloying element, silicon in small percentages will increase the tensile strength, yield point, and ductility of structural steels, such as those used for highly stressed parts of bridges. Some spring steels contain about 2 per cent silicon. Another application of silicon as an alloying element is in stainless steels, where it appreciably increases the resistance of these steels to certain types of corrosion and to high-temperature oxidation.



Effect of silicon on tensile strength and yield point of a steel containing approximately 0.10 per cent carbon.

Decreases Watt Loss

Silicon increases the magnetic permeability of steel. Hence silicon steel is specially suited for use as a "core" material in electrical generators, motors, transformers, electromagnets, and other electrical equipment. Because silicon decreases magnetic resistance, silicon steels show much lower eddy current losses. As a result, energy or watt losses are greatly decreased and tremendous overall savings are effected in the generation, transmission, and use of electrical power. Up to 5 per cent silicon is used in sheet steel for electrical apparatus.

Benefits Cast Iron

In cast iron, silicon not only serves as a deoxidizer but also has a marked graphitizing effect. Silicon tends to soften cast iron, thereby improving machinability and providing a control over depth of chill and physical properties. In larger amounts, sometimes as much as 14 per cent, silicon makes cast iron suitable for handling highly corrosive acids in chemical plants.

Improves Non-Ferrous Alloys

Silicon is used in non-ferrous alloys to increase strength and hardness, and to improve other physical properties. In various aluminum alloys, as much as 18 per cent silicon may be used. Copper alloys, too, frequently contain silicon: for example, the silicon bronzes.

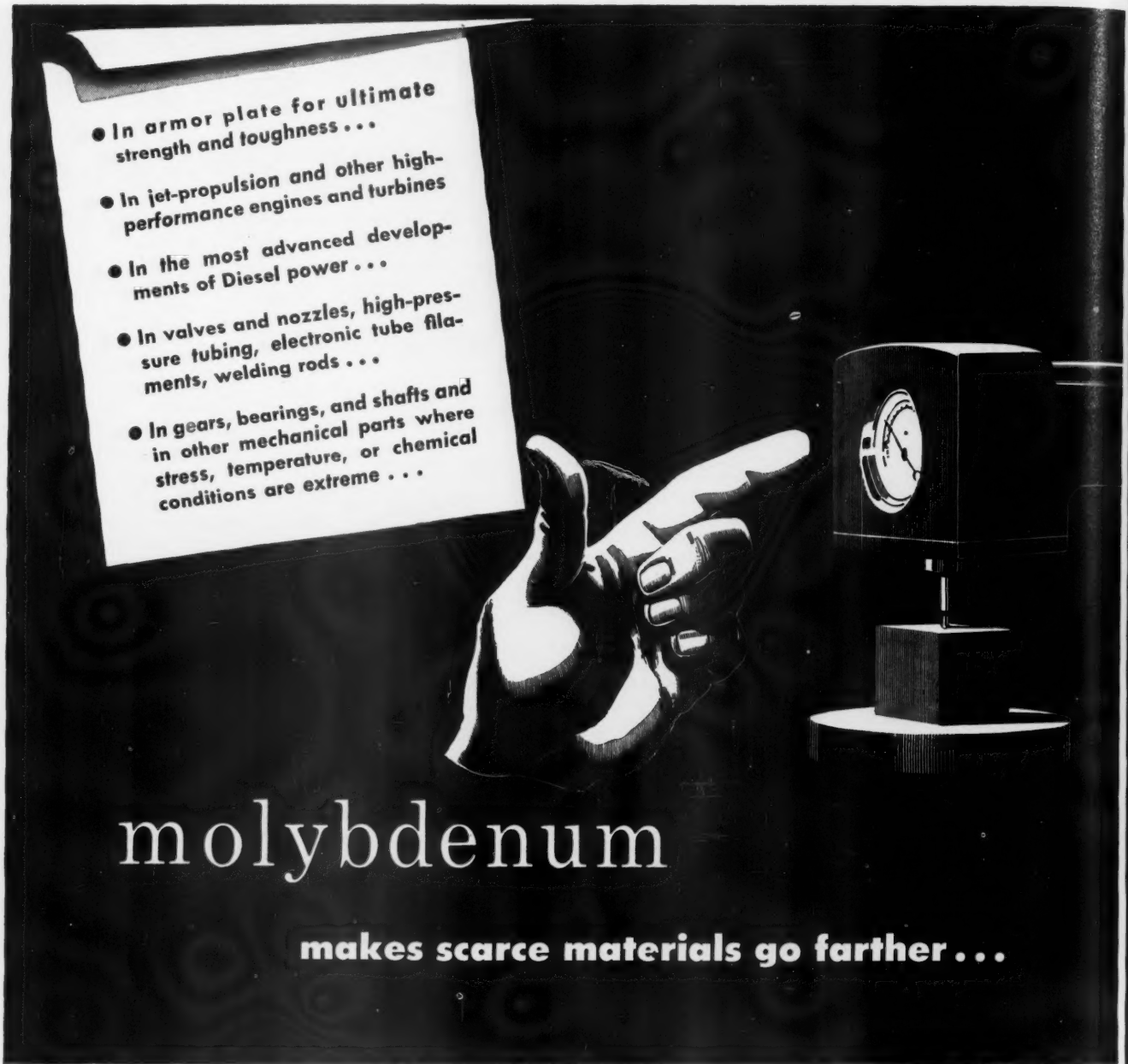
Available Alloys

Silicon is produced by ELECTROMET in the forms listed below, which are suitable for every use of the iron, steel, and non-ferrous metal industry. For a complete description of these alloys, write to the address above for a copy of the 100-page booklet, "ELECTROMET Ferro-Alloys and Metals." This booklet describes over 50 metals and alloys produced by ELECTROMET and tells of the unique technical service offered to the metal industries.

The terms "Electromet," "EM," and "SMZ" are trade-marks of Union Carbide and Carbon Corporation.

Alloys of Silicon and Their Uses

15% Ferrosilicon	In ground form, this alloy is used in the "sink and float" process of concentrating ores.
50% Ferrosilicon	Widely used as a deoxidizer; as a furnace block; and for adding silicon to fill specifications in the production of steel. Also used in the production of cast iron.
65% Ferrosilicon	Used mainly in the production of electrical sheet steel. (Available in low-aluminum grade only.)
75% Ferrosilicon	Used both as a deoxidizer and for alloying purposes in the production of steel, particularly steel containing high percentages of silicon. Also used for ladle additions to cast iron.
85% Ferrosilicon	Used for same general purposes as 75% ferrosilicon. Permits large silicon additions without harmful chilling effects.
90% Ferrosilicon	Used for same general purposes as 75% and 85% ferrosilicon. Permits large silicon additions without harmful chilling effects.
Silicon Metal	For use in the non-ferrous industry, particularly in the manufacture of aluminum and copper alloys. Also used to produce the organo-silicon compounds known as silicones.
Purified Silicon Metal	For special applications requiring silicon metal of the greatest purity.
"SMZ" Alloy	For ladle additions in the production of cast iron. Exerts strong graphitizing effect.
"ELECTROMET" Special Graphitizer	For ladle additions in the production of cast iron.
"EM" Silicon Briquets	For adding silicon to cast iron in the cupola or air furnace.
Silicomanganese	For adding silicon and manganese simultaneously in steel making processes.


• In armor plate for ultimate strength and toughness . . .
• In jet-propulsion and other high-performance engines and turbines
• In the most advanced developments of Diesel power . . .
• In valves and nozzles, high-pressure tubing, electronic tube filaments, welding rods . . .
• In gears, bearings, and shafts and in other mechanical parts where stress, temperature, or chemical conditions are extreme . . .
molybdenum
makes scarce materials go farther . . .

IN CRITICAL USES too many and varied to mention, it was learned under the stress of war demand that tungsten, manganese, nickel, chromium—any one of several indispensable alloying materials could be reduced in percentage and so made to go farther by judicious additions of Molybdenum.

No alloying agent is more easily introduced in various compositions; none is more tolerant in the presence of other elements. Nowhere else is Molybdenum so abundant as in the United States.

The subject is timely. Correspondence is invited on any prospective use of Molybdenum, Tungsten, or Boron.

AMERICAN Production, American Distribution, American Control, Completely Integrated.

Offices: Pittsburgh, New York, Chicago, Cleveland, Detroit, Los Angeles, San Francisco, Seattle.

Sales Representatives: American Steel and Supply Co., Chicago; Edgar L. Fink, Detroit, Brumley-Donaldson Co., Los Angeles, San Francisco, Seattle.

Subsidiaries: Cleveland-Tungsten, Inc., Cleveland, O.; General Tungsten Manufacturing Co., Inc., Union City, N. J.

Works: Washington, Pa.; York, Pa.

Mines: Questa, New Mexico; Urad, Colorado.

MOLYBDENUM

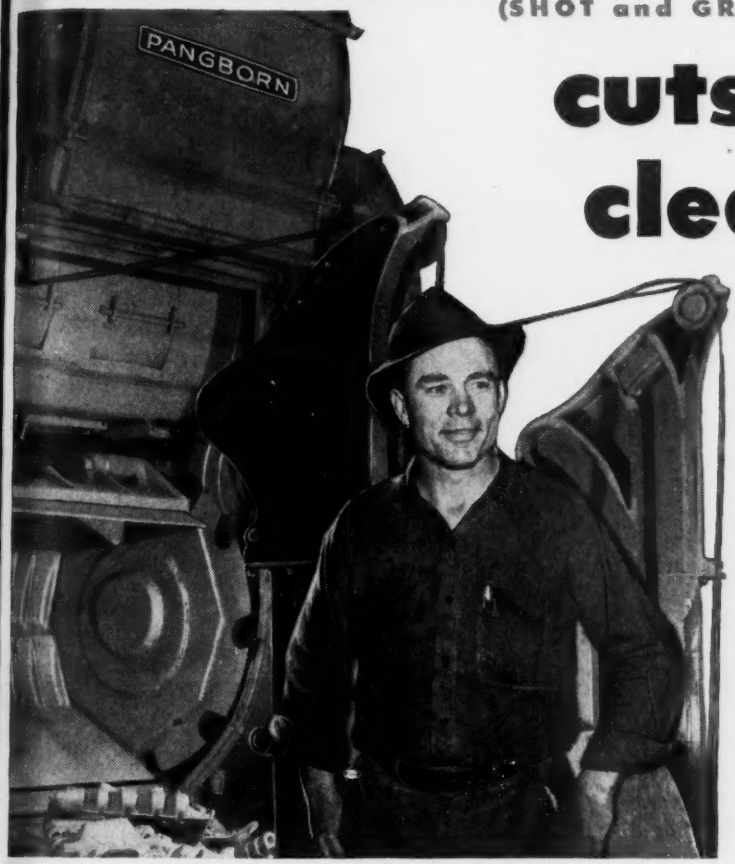
CORPORATION OF AMERICA
Grant Building Pittsburgh, Pa.

MCA

TESTS PROVE

MALLEABRASIVE®*

(SHOT and GRIT)



cuts blast cleaning costs

57.2% Company A

51.8% Company B

35.9% Company C

58.9% Company D

Yes, these actual reports from four leading foundries† prove Malleabrasive saves up to $4000 per machine per year, cuts cleaning costs 50% and more.

TESTS LIKE THESE PROVE again and again that Malleabrasive lasts 2 to 4 times as long as ordinary chilled shot and grit. With Malleabrasive in your plant, wearing parts last up to 3 times longer . . . costly machine down-time is cut, material handling costs drop and tonnage cleaned per hour goes up. Total cash saving with Malleabrasive can often amount to 50% to 60% of your blast cleaning costs.

TEST MALLEABRASIVE in your plant. See for yourself why Malleabrasive is *guaranteed* to outperform conventional abrasives. The Pangborn Corporation will provide all necessary charts and equipment. Write for free TEST KIT today! Address: PANGBORN CORPORATION, 1400 Pangborn Boulevard, Hagerstown, Maryland.

Use Pangborn's free ABRASIVE ANALYSIS SERVICE!

Pangborn Service Engineers are skilled specialists, backed by Pangborn's 46 years' experience with blast cleaning and as pioneers with metallic abrasives. These men can tell you which size Malleabrasive will save you the most money for your type of work. Ask for a free recommendation. In your letter just tell us what you clean and the type of equipment you use.

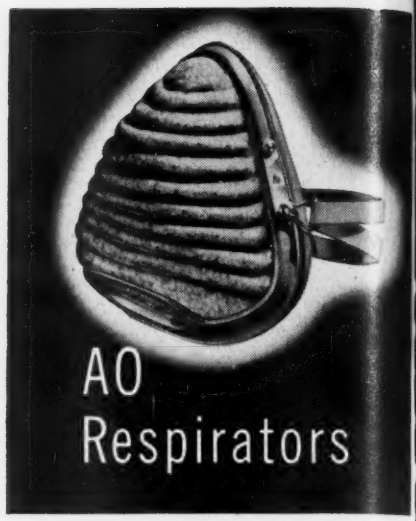
Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

Pangborn

BLAST CLEANS CHEAPER with the right equipment for every job

*U. S. Patent #2184926 (other patents pending)

†Names of companies upon request.



Light **IN WEIGHT...**

Right **IN PRICE!**

AO R9100 TYPE RESPIRATOR

The low cost of this BUREAU OF MINES APPROVED Respirator has always appealed in dusty operations where a soundly made respirator of simple construction is adequate.

The R9100 protects against *pneumoconiosis-producing* and *nuisance dusts* such as aluminum, borax, carbon, cement, charcoal, coke, flour, glass, grain, graphite, gypsum, limestone, pollen and wood. The companion respirator R9100T should be specified for protection against dusts that are not significantly more toxic than lead, such as barium, cadmium, lead arsenate, manganese and organic dusts—also for protection against DDT and insecticide sprays of similar potency. BUREAU OF MINES APPROVED numbers are BM 2137 and BM 2144 respectively. Your nearest AO Safety Products Representative can supply you.

QUICK FACTS

- Simply constructed of a smooth, rubber face mask and a corrugated permanent felt type filter, reinforced by wire frame.
- Easy to breathe in; non-reversing, low-resistant valve does not stick, is out of way. Easily replaceable.
- Lightweight (1½ oz.) for comfort. Soft rubber, smooth edges, self-adjusting double headband.
- Unobstructed vision—fits close to face, may be worn under helmet or with goggles.
- Easily cleaned — a shake, slap of the hand or light blast from air hose removes dust.

American Optical
COMPANY
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

SOLID STEEL HEADS, CAPS and MOUNTINGS MACHINED from SOLID BAR STOCK
HARD CHROME PLATED PISTON RODS
DIRT WIPER SEALS
NON-CORROSIVE BRASS BARRELS

Miller
TRADE MARK REGISTERED

AIR CYLINDERS

SOLID STEEL HEADS, CAPS and MOUNTINGS. Eliminate dangerous, costly breakage under even the severest operating conditions . . . assuring longest possible cylinder life. Standard construction on ALL Miller Cylinders—*both Air and Hydraulic.*

HARD CHROME PLATED PISTON RODS. 90,000 to 110,000 psi yield point heat treated stress relieved steel, accurately ground, polished, then hard chrome plated for extra high resistance to the scratches that commonly cause leakage.

DIRT WIPERS. Wipe piston rods clean on every "in" stroke, protecting piston rods, seals, and bushings from scratch-damage by dirt, scum, abrasive particles. Standard construction on ALL Miller Cylinders — *both Air and Hydraulic.*

NON-CORROSIVE BRASS BARRELS. Eliminate the rust and corrosion caused by moisture always prevalent in plant air lines. Standard construction on all Miller Air Cylinders.

Benefits to You

No Broken Castings
No Scratch-Damage to Piston Rods, Bushings and Seals
NO COSTLY "DOWNTIME"
NO REPAIRS
NO MAINTENANCE
NO POWER WASTAGE

Write for illustrated cylinder bulletins A-105 and H-104

COMPLETE MILLER CYLINDER LINE INCLUDES: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FOR 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. ALL MOUNTING STYLES AVAILABLE.

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MILLER MOTOR COMPANY

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AIR AND HYDRAULIC CYLINDERS · ACCUMULATORS · COUNTERBALANCE CYLINDERS · BOOSTERS · AIR HOISTS

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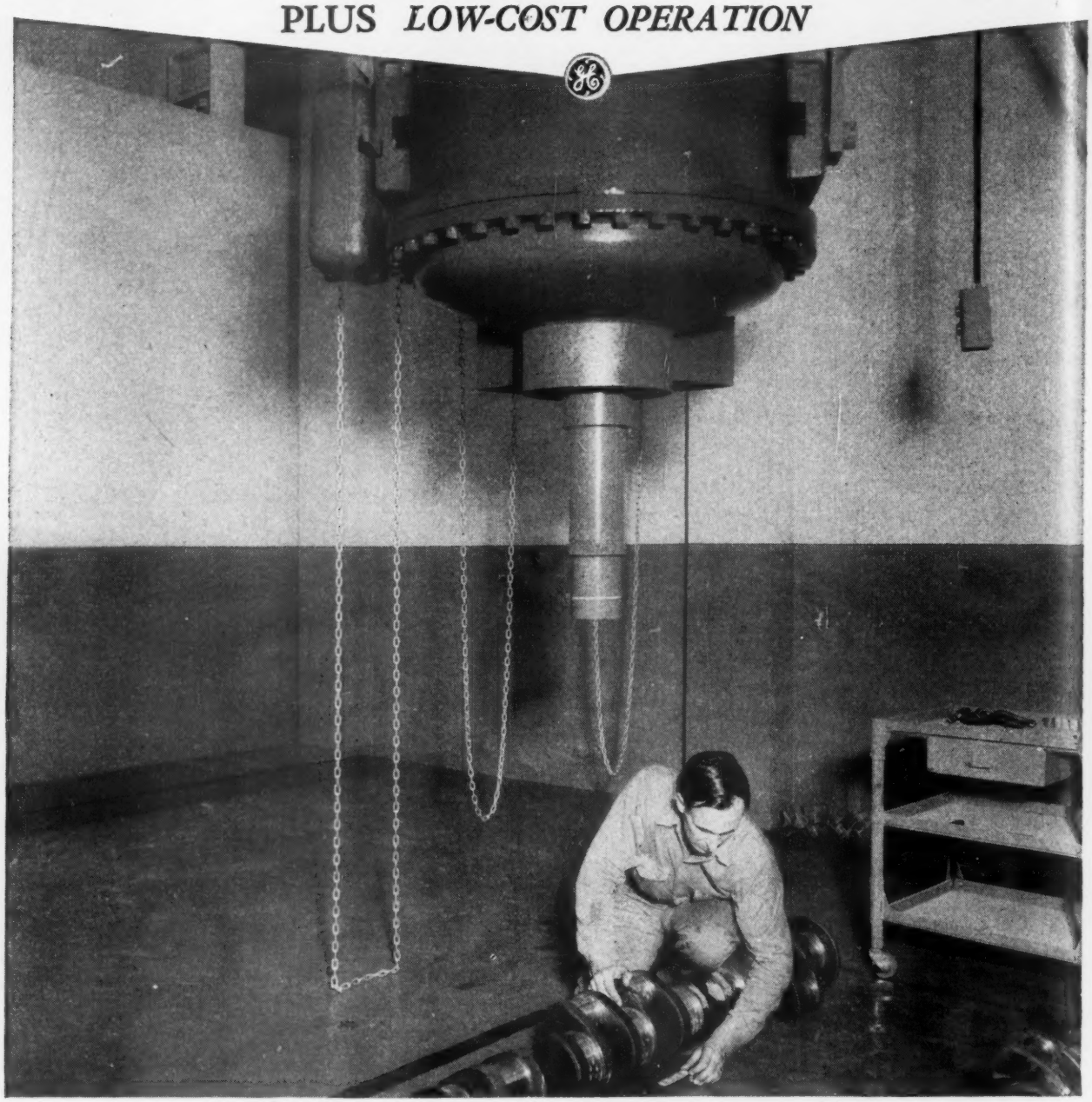
Sales and Service from coast to coast

PROVEN DEPENDABILITY YEAR IN—YEAR OUT

PLUS *LOW-COST OPERATION*



(Installation of 1,000,000-volt unit — Campbell, Wyant and Cannon, Muskegon, Mich.)

General Electric Industrial X-Ray is a production tool that often pays for itself on the first job!

Scores of companies rely on radiography for that extra measure of assurance that comes from knowing — not guesswork. The high-voltage industrial x-ray unit illustrated above is noted for its low-cost operation and absolute dependability. Developed to high efficiency to satisfy the hectic production demands of World War II, it ideally meets today's foundry needs — both in the laboratory and on the production line.

Here's the experience of a Michigan automobile manufacturer: "An outstanding example of the contribution of radiography to the improvement of production processes resulted when examination of one type of crankshaft showed lack of fusion at the chill and pointed the way to improved techniques resulting in a savings conservatively estimated by the company to be $250,000 on a year's production." Write for booklet: "Radiography as a Foundry Tool." General Electric X-Ray Corporation, Dept. YY1, Milwaukee 14, Wisconsin.

GENERAL ELECTRIC X-RAY CORPORATION

A COMPLETE LINE

If you have been buying only one or two CMD products such as slip jackets or core trays, you may not realize that we also furnish many other supplies for foundries.

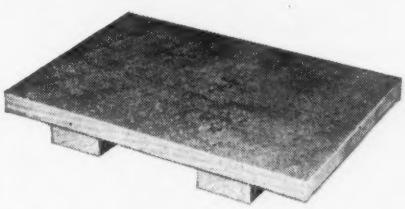
CMD NON-BURN SLIP JACKETS

CMD FOUNDRY SPECIALTIES

CMD PNEUMATIC CORE TRUCKS

Pneumatic tires and CMD inner coil spring construction in the upright supports completely absorb bumps and jars *before* they reach the cores. No chafing! No breakage! There's a CMD Pneumatic Core Truck exactly right for your needs.

Model A-27 (illustrated above) is available in the following sizes: 27" x 60"—1,000 lbs. cap.; 27" x 72"—1,200 lbs. cap.; 27" x 84"—1,400 lbs. cap.



CMD WOOD BOTTOM BOARDS
All sizes and shapes

INCLUDE:

- Wood Floor Flasks
- Cross Bars
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- Slip Jackets
- Hand Riddles
- Crucible Skimmers
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- Slag Skimming and Rabbling Irons
- Chipping Hammers
- Air Separators
- Bag Holding Trucks
- Pneumatic Core Trucks
- Pneumatic Core Barrows
- Resilient Rack Core Trucks

Write Dept. 1-F For Free Circulars

on CMD foundry equipment and specialties including complete specifications and price list.

CHICAGO MANUFACTURING & DISTRIBUTING CO.
1928 West 46th Street **Chicago 9, Illinois**

Increase Production

with the

ROTOPLANE SPEED SIFTER ★ RED ELECTRIC VIBRATORS

ROTOPLANE SPEED SIFTER

The ROTOPLANE Speed Sifter is an *improved* sand riddle of much greater capacity and much longer life. One size and type serves all purposes in the foundry—does *all* your sifting more quickly and economically.

It is easily handled by one man, weighs approx. 90 lbs. is 62 in. high overall. The one-piece frame of tough aluminum alloy makes for a remarkably effective vibration. Its smooth, free, rotary action vastly increases bearing life; all bearings grease packed. All mechanism of the ROTOPLANE is *completely* enclosed—no bearings or activating parts of any kind exposed to dust and grit.

The Quick-Change Sieves are instantly interchangeable, mounted in smooth, flat steel ferrule, with 20-inch diameter clear sifting area. No jagged edges to tear workers' hands, no storage problem.

$270.00 f.o.b. Chicago—complete with cable, safety ground wire. Standard 1/3 h. p. motor, 110 volt, 60 cycle, single phase and 220 volt, 1 or 3 phase.

UNIVERSAL FREE - WHEELING RIDDLE equipped with motor as above $245.00

RED ELECTRIC VIBRATORS

True-to-pattern castings make satisfied customers . . . more repeat business. Increase your production and castings quality with RED Electric Vibrators. Sturdy, dustproof, lowest operating cost (electricity does not freeze). Unequaled for consistent year-'round results in foundries all over the world.

(All Prices f.o.b. Chicago)

No. 1—Light match plate work	$11.00
No. 2—Medium match plate work	13.00
No. 5—Heavy match plate, tub and bench work	17.00
No. 9—Machine and heavier work	26.80

Third (ground) wire per U. S. Govt. code—furnished with No. 9 at no extra cost; $1.20 extra with Nos. 1, 2 and 5 vibrators.

KNEE SWITCHES for operating Red Electric Vibrators:
Single pole $5.00, Double pole $6.50.

FOUNDRY SUPPLIES MANUFACTURING CO.

2221 Orchard Street **Chicago, Illinois**

CABLE ADDRESS: "ROTOPLANE CHICAGO"

Ajax-Northrup Induction Melting

"NO OTHER METHOD GETS SO MUCH OUT OF THE MOLTEN METAL"

Says I. E. Waechter, Chief Metallurgist, Alloy Precision Castings Company.

Users from all over the country praise the ability of Ajax-Northrup high frequency furnaces to give back what you put into them . . . no alloy loss, no carbon contamination . . . no off-analysis melts. Even the most difficult analyses, high in chromium, tungsten, nickel, and other "hard-to-handle" elements, are reproduced in melt after melt with unfailing precision!

Recovery of oxidizable alloys is phenomenally high . . . 98.5% chromium recovery reported by one user, 70 to 80% vanadium recovery by another. Savings in alloying elements and deoxidizers alone give Ajax-Northrup a two-to-one advantage in a nickel steel plant.

Ajax-Northrup furnaces are available in sizes from an ounce to a ton for non-ferrous and precious metals, to 8 tons for ferrous metals. Motor-generator units from 25 to 1200 kw. and up. Self tuning, trouble-free spark-gap converters from 3 to 40 kw. Just name your alloys and quantities—we'll send you the proper technical bulletins—free.

AJAX NORTHRUP

HEATING & MELTING

Associate Companies

AJAX ELECTRO METALLURGICAL CORP.
AJAX ELECTRIC FURNACE CORPORATION
AJAX ELECTRIC COMPANY, INC.
AJAX ENGINEERING CORPORATION

127

AJAX ELECTROTHERMIC CORPORATION • AJAX PARK • TRENTON 5, NEW JERSEY

I know—
"CERTIFIED"
is the best abrasive
As Purchasing Agent I have to see that the abrasive we use is the most economical. This means a hard, slow wearing abrasive like "Certified" . . . one that can be used over and over. An abrasive that does a good job in the cleaning room . . . one that gets castings really clean in a hurry.
"CERTIFIED" IS TOPS! Each grain of Samson Shot and Angular Grit is a solid homogenous mass that wears slowly, lasts longer for top-efficiency blast cleaning at lowest cost. "Certified's" special automatically controlled hardening process gives 'em plenty of extra hardness for cleaner castings. Order "Certified" today for faster, better, cheaper blast cleaning.
100 LBS.
BOSTON, MASS.
USE NO HOOKS
100 LBS.
ANGULAR
GRIT
PITTSBURGH CRUSHED STEEL CO.
PITTSBURGH, PA. U.S.A.
USE NO HOOKS
MEMBER FEMA
Always specify "Certified"
PITTSBURGH CRUSHED STEEL CO.
PITTSBURGH, PENNA.
STEEL SHOT AND GRIT CO.
BOSTON, MASS.

Readers' COMMENT

The Modern Viking

TO THE EDITORS:

With reference to my letter of May 12, 1950 and your kind answer, I have sent the issue of the journal *Erhvervsliv*, with the extract of your article of November, 1949, "What Are Foundries Doing About Public Relations?"

C. E. Meilby Madsen

I thank you for your kind little note in FOUNDRY, September, 1950 page 212, entitled "Seeks Public Relations Data." Here we call it "a fresh manner" and the cartoon of the old Viking is very funny and here characterized as a teen-age-portrait of my 33-year-old person.

Now reader Madsen is sitting in "Valhalla" waiting for results of your kind relation. Enclosed I send you a picture of a Danish Viking of today.

C. E. MEILBY MADSEN
Advertising Manager
De Forenede Jernstberier A/S
41 V. Faringsgade
Copenhagen, Denmark

* * *

Tips From a Molder

TO THE EDITORS:

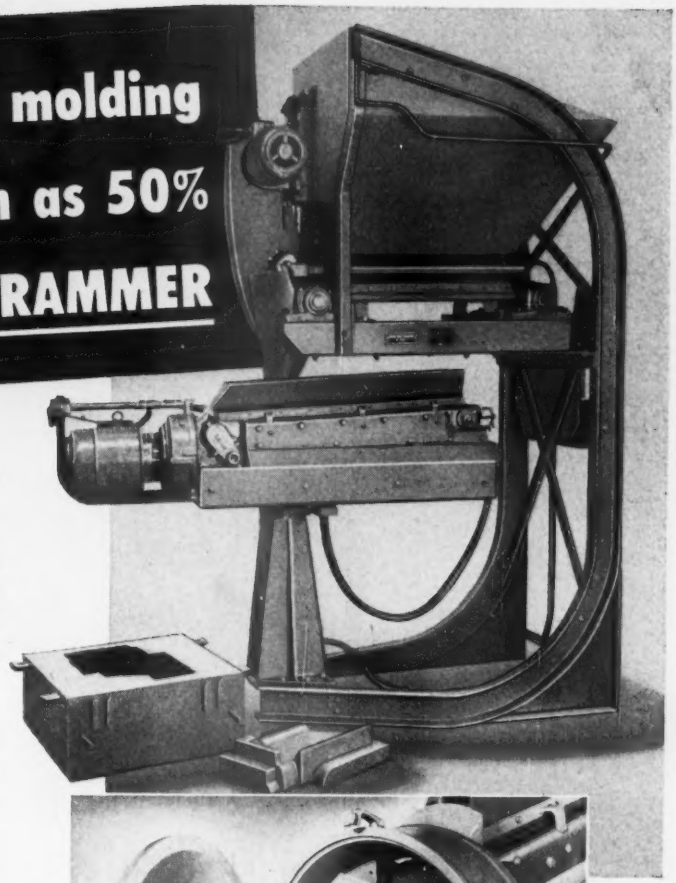
For several years I have read with enjoyment Ralph Lee's articles, "Man to Man on the Molder's Bench." As a journeyman molder of many years' experience in jobbing shops, I get a kick out of seeing foundries through the minds of hobbyists and amateurs.

In one article you described the troubles experienced in lifting that little cope, and I thought you might appreciate a litte tip in flask rigging, or a sort of "rule of thumb" used by jobbing shop molders. Any flask over 256 square inches needs a bar—that is, any area over 16 in. square of sand in the cope should have a bar for support. Rigidity of the cope is of prime importance. Anyway, that is what us birds who make our living out of molding figure, in these small jobbing shops out west.

I remember in one of your articles you described a tool known to us as a "rapping wrench," used by bench

(*Continued on page 70*)

TABOR SAYS...Reduce molding costs by as much as 50% with "JUNIOR" SANDRAMMER



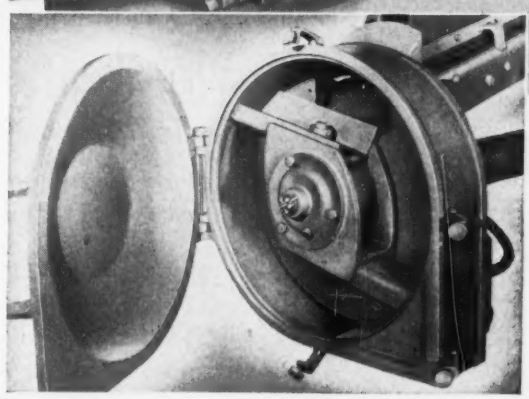
GREATER RAMMING SPEED AND FLEXIBILITY are the reasons behind "Junior's" ability to cut costs.

SPEED—The new-type Impellor Head rams molds at a phenomenal rate. Trolleys and swivels are finely balanced, ball-bearing mounted for ease of operation. Simple, sequence, push-button controls are at the operator's finger tips.

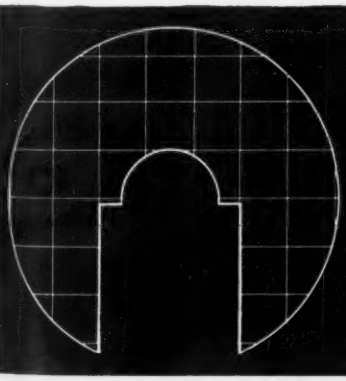
FLEXIBILITY—"Junior" quickly pays for itself in core room or on small jobbing floor. Ideal for ramming up molds from loose patterns, for short-run core making, and for handling light to medium production work in both core room and foundry. Can be moved by crane from area to area, or mounted on rail-car for along-track ramming. Adaptable to hand, hoist, or over-head system sand feeding.

PLUS—Low original cost, long trouble-free life, low operating and maintenance costs.

Summed up, "Junior" Sandrammer is a machine you can keep at work *all day, every day.* That means sound investment—quick pay-off.



Adjustable, multi-blade impellors give greater ramming speed and five-fold life. Simple blade adjustment compensates for wear and controls density of mold. Rams mold with equal density throughout whole area and depth.



The blocked portion of this diagram shows working floor area covered by ramming head of "Junior" Sandrammer. Since each block represents one square foot, this sketch quickly tells you the combined maximum lengths and widths of molds which the "Junior" can handle.

"JUNIOR" SPECIFICATIONS

Height from floor to top of hopper	8'- 8¾"
Height from floor to sand discharge point	2'-10½"
Max. height of flask	2'- 9½"
Hopper capacity	675 lbs.
Sand throwing capacity	Up to 150 lbs. per minute

Write, wire or 'phone.
A Tabor engineer will be ready to team up with you.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

The TABOR *Manufacturing Co.*

SINCE 1884 MANUFACTURERS OF FOUNDRY MOLDING MACHINES
6225 TACONY STREET • PHILADELPHIA 35, PENNA.

Tabor Manufacturing Co. is licensed to manufacture and sell Sandrammers by Foundry Equipment, Ltd., Leighton Buzzard, Bedfordshire, England.

Electro's NEW CUTRITE CUT-OFF WHEELS

Cut 2" x 1¾" Risers On Nickel Iron Castings in 16 Seconds!

With all this new defense work coming up, you've got to save *time;* minimize waste; and get jobs done right the first time.

On preparatory jobs, Electro's New Cutrite Cut-Off Wheels already have proved their worth by setting such records as . . .

9500 cuts on ¼" alloy valve stock; cutting 2" x 1¾" risers on nickel-iron castings in 16 seconds; showed no binding or breakage on 5½" x 2½" heavy, stainless, alloy steel castings which are normally burned; outlived and outperformed competitive wheels on 15/32" carbon steel, drill bit rod; and gave 46.6% longer service than the average of competitive wheels on stainless, low carbon, beryllium copper, silicon bronze and manganese bronze 1" stock.

Let us show you on the job *what these new wheels can do for you; and what other Electro High Speed Grinding Wheels can do for you on both rough and precision grinding. Write, wire or phone. No obligation for Field Engineer cooperation.*

Electro manufacturers: *HIGH-SPEED* **resin-bonded GRINDING WHEELS • CRUCIBLES • REFRACTORIES, Standard and Special Shapes • Electro-Carb BRIQUETS SiC Deoxidizer • STOPPER HEADS • POROUS MEDIA ELECTRO-CARB (SiC) ABRASIVE GRAIN and GRITS.**

Electro SINCE 1919

Electro Refractories & Alloys Corporation
344 DELAWARE AVENUE • BUFFALO 2, NEW YORK
West Coast Warehouse . . . Los Angeles • Canadian Electric Furnace Plant, P. Q.

(*Continued from page* 68)

molders. This little tool has a handle and a sort of wishbone effect at one end and is used for loosening small patterns or small loose pieces from the sand, and is very handy. You said in your article that you were going to cast yourself one. I have a small one I cast from bronze many years ago and it saw a lot of use when I was an apprentice kid. Also I have a cast bronze double ender made and used in the 1890's by an old Swedish molder. Since I have no further use for these two items, I would be glad to send them to you for curios.

In one article where you talked of things you had made in your hobby foundry was a picture of the famous "cup, saucer and spoon." If you made this little item in green sand you know something of the principles of trick molding. You can also have some fun with an old cast iron toy railroad car. Take out the rivets which hold it together and slick up the toy a little with a file, emery paper and steel wool and use it as a split pattern. Cast it in a two part mold in green sand. You can carefully take the vent out from the interior of the car from underneath the car and through the windows. The car is cast in one piece. Wheels are cast separately. Also, those old-time cast iron toy horses offer the same deal. The vent for the green sand core which forms the interior is taken out the belly of the horse. Small chaplets are made or procured to help support the core in this case.

With reference to paragraph two above, don't forget there are such things as gaggers, soldiers and arbors to be used together or singly in difficult lifts. No job is difficult if you know how.

H. H. PETERSON
140 *West 22nd St.*
Durango, Colo.

* * *

Pig Iron Shortages

TO THE EDITORS:

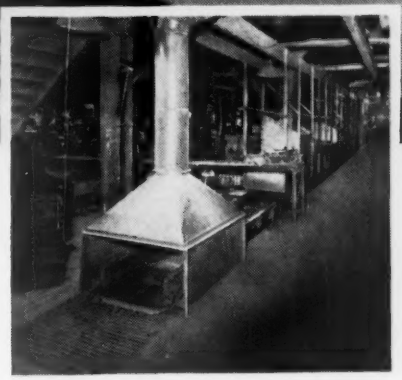
I very much enjoyed your editorial page in the October issue of THE FOUNDRY, and it makes me wonder why the gray iron industry has not followed a different line of approach. Since I have been active in the foundry industry some 25 years I have seen many periods of pig iron shortages which are almost always accompanied by elimination of the spread between pig and scrap. On the other hand, during the time I have been in it, the industry has accepted nonferrous ingot as a standard material substantially as good as, and in many cases

(*Concluded on page* 72)

ANNOUNCING THE HEWITT-ROBINS

Vibra-Veyor

UP TO 200 FEET OF PAN LENGTH ON ONE VIBRATOR!



A Better, Faster Way To Move Hard-To-Handle Materials

Here's the machine to convey anything you can't handle with a belt conveyor! Hot or cold . . . wet or dry . . . lump or pulverized . . . packaged or bulk . . . Hewitt-Robins' new Vibra-Veyor® moves it quickly, quietly, efficiently, at low cost.

Convey material up to 200 feet on one vibrator! Run the Vibra-Veyor horizontally . . . down-hill . . . on grades up to 10% . . . all with *one* vibrating unit . . . save on power!

Load it to the hilt! Load the Vibra-Veyor at several points along the pan—with practically any material—and it won't bog down. Capacity is limited only by the size of the troughed pan.

Give it rough shock loads! Pan sections are supported by tough malleable iron rockers and soft coil springs . . . *springs whose sole function is to counteract shock loads.* The Vibra-Veyor is amazingly quiet; like the famed Hewitt-Robins Floatex®, its vibrating mechanism is full floating.

Install it easily! The Vibra-Veyor requires no special foundation because there's no vibration in the base structure. Your own men can anchor it easily. Maintenance is simple; only four points to lubricate!

Use it for any material! Vibra-Veyor applications are almost limitless. Tell us your hard-to-handle materials handling problem, and we'll build a Vibra-Veyor to solve it. (For example, it's ideal as a foundry mold shakeout conveyor, with multiple feeds along its length.)

Write for Bulletin 135 and get the whole story. Robins Conveyors Division, Passaic, New Jersey.

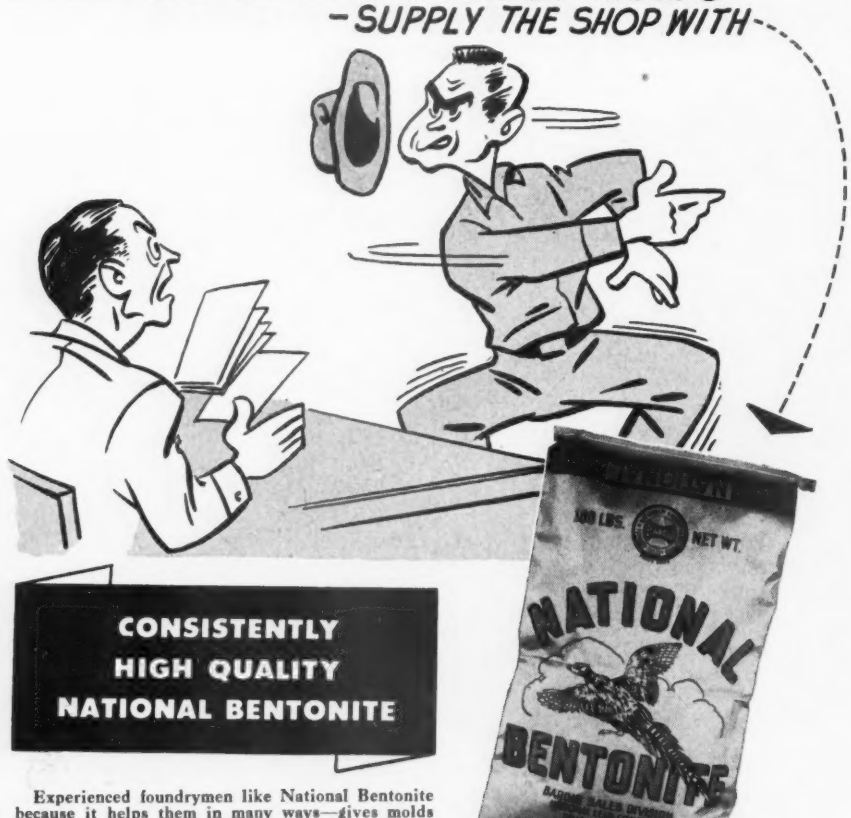
A MECHANIZED FOUNDRY — MEMBER FEMA FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. — BENEFITS EVERYONE

HEWITT-ROBINS
VIBRA-VEYOR

HEWITT-ROBINS HR INCORPORATED

BELT CONVEYORS (*belting and machinery*) • BELT AND BUCKET ELEVATORS • CAR SHAKEOUTS • DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS • FOUNDRY SHAKEOUTS • INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS • RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS • TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

IF YOU WANT US TO MAKE GOOD MOLDS
-SUPPLY THE SHOP WITH-



CONSISTENTLY
HIGH QUALITY
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BENTONITE SALES OFFICE
RAILWAY EXCHANGE BLDG.
CHICAGO 4 • ILLINOIS

(*Concluded from page* 70)

better than, virgin metal charges. No self-respecting brass foundryman purchases scrap on the open market for formulating charges.

It seems to me that the pig iron situation could be alleviated considerably if there were some strategically located refining units in which our miscellaneous scrap iron could be melted down and put back on the market as standard analysis pigs.

CARL H. MORKEN

Donovan, Inc.
St. Paul

* * *

An Invitation from Britain

TO THE EDITORS:

I am writing to thank you and, through FOUNDRY, the many friends I made during my recent tour in the States and Canada. Americans are renowned for their hospitality, but one has to receive it to realize and appreciate what it means.

During my visits to the various foundries I was very impressed with the manner in which every detail of production was shown to me.

A number of foundrymen told me that they were contemplating visiting Europe in 1951 and you may not know that this is the year of the Festival of Britain. I do hope that as many as possible of my friends will visit this country and give me an opportunity of returning, in a very small way, the hospitality I received in the States and Canada.

Apart from the many interesting things to do and to see, we also have an interesting foundry industry, and I cannot help but feel that it is common with all foundrymen that when they visit a country other than their own they always like to see a foundry.

Your very excellent journal is well known in this country, and when one reads it every month, and one sees names, one often wonders what these people are like. Strange to relate, when I met the many members of your staff they all came up to my expectations.

Although I had never seen a photograph of Pat Dwyer, his very impish articles are typical of him, and he is probably one of America's best known characters in the foundry industry of this country.

W. TAIT

Stone-Wallwork Ltd.
157 Victoria Street
London S.W. 1, England

Volume increased by complete mechanization

No lost motion from cupola to finished product

These three views were taken in a recently-modernized Malleable Foundry . . . Jeffrey-equipped for non-stop production. Here is sand and casting handling at its best. We would like to tell you more about it.

Jeffrey Mold Conveyors, Trolley Conveyors, Belt Conveyors, Steel Apron Conveyors, Continuous Molding Stations and Electric Vibrating Feeders . . . all contribute to the success of this high-speed foundry operation. Write for more details . . . if you are looking for peak efficiency and increased volume.

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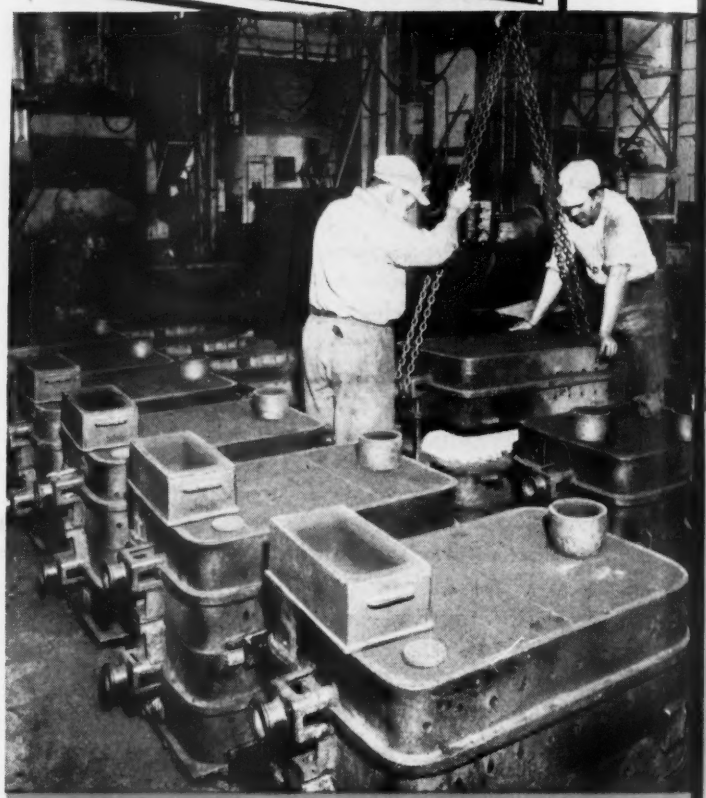

Sterling Style ⅜ NS-RT Flasks in a large midwest high production foundry. Used for producing grey iron automobile engine castings. Flasks are equipped with heavy duty cast steel trunnions, clamps and clamping bars.

So called cheap flasks may be costly in the long run. Play safe. Buy Sterling Steel Flasks. They last longer . . . Produce better castings . . . Cost less per year. Available in a variety of shapes and sizes.

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Why Does Production Lag?

OUR country has just suffered one of its greatest military defeats. If it is to survive as a free nation, every resource must be turned to building a war machine capable of meeting the challenge of those mad nations who would conquer us.

American industry has been waiting months for the go-ahead signal, but to date only a small percentage of the industrial capacity is being utilized for war purposes. Why have war orders been so slow in materializing?

First, the Department of Defense has been anything but fast in determining what machines and materials are needed. Time and again, branches of the industry and various advisory committees have asked for a bill of materials, but such information has not been provided.

Second, in establishing control agencies under the Defense Production Act, the President has placed authority in the hands of the Department of Commerce, Department of Labor, Department of Interior and other regular government agencies. In most cases key personnel has been secured from these departments. Many of the men transferred from these regular departments to the new war agencies do not display the temperament or outlook needed to solve the difficult problems that lie ahead. They are bureaucrats. In the main they do not reveal a sense of urgency so necessary in developing war production. As a class, they cite too many reasons why things cannot be done. They are past masters in the fine art of promulgating red tape. They do not understand that in war, the impossible must be accomplished.

Third, until recently the President has refused to permit men from business and industry to serve the government on a dollar-a-year or without-compensation basis. While this unfair and dangerous ruling has been relaxed, much time has been lost in building an organization qualified to handle war production.

Many intelligent men in business and industry are willing to make the sacrifice and offer their services to the government for this emergency. And don't let anyone tell you that such service is not a sacrifice.

But these men are not going to step forward, only to be insulted by the President and blocked at every move by the red-tape artists.

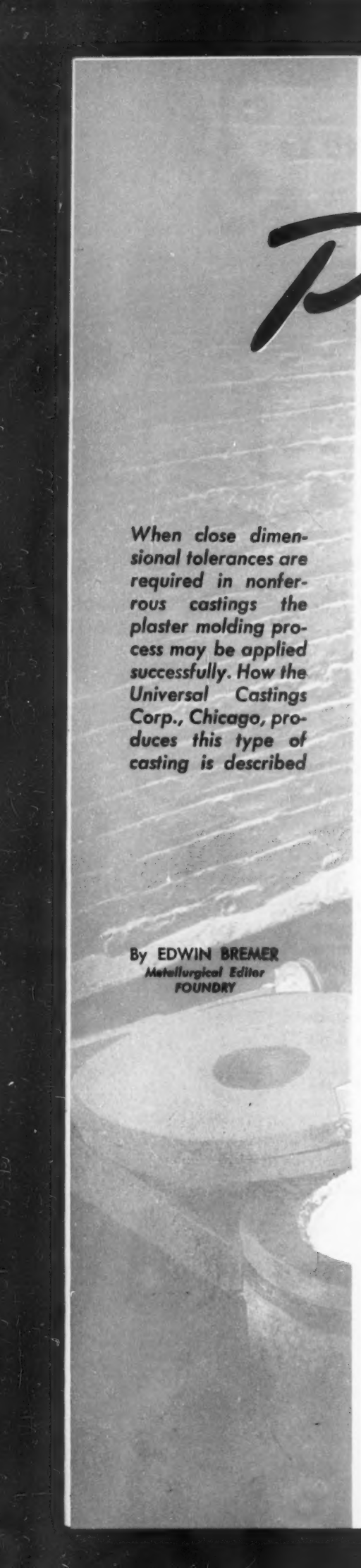
Let's cut out the horseplay and get going in this war production problem!

Frank G. Steinbach
Editor

Plaster Molds

GIVE CLOSE TOLERANCES

When close dimensional tolerances are required in nonferrous castings the plaster molding process may be applied successfully. How the Universal Castings Corp., Chicago, produces this type of casting is described



By EDWIN BREMER
Metallurgical Editor
FOUNDRY

MANUFACTURE of small castings to extremely close tolerances by the plaster molding process on a production basis requires careful control and co-ordination of all operations from making the pattern to final inspection of the finished product. At Universal Castings Corp., Chicago, a number of ingenious arrangements have been developed to perform certain operations automatically, and thus reduce the chance of error.

In brief, the plaster molding process consists of the five steps of pouring liquid plaster mix into the mold, the setting period, extracting moist plaster mold from flask, drying the mold and filling the casting cavity with molten metal.

Since the patterns must be designed for the plaster process and take into consideration such features as contraction and expansion characteristics of that molding medium, desired tolerances on dimensions of finished casting, and shrinkage of the alloy to be used, the firm makes all of its patterns. Brass plate and bar stock of various shapes is the pattern material employed. While other materials have been tried, brass appears the most practical, and produces castings with extremely smooth surfaces.

Patterns are made to conform in size to what the Universal Castings Corp. terms the "unit strip" system, developed to provide considerable flexibility in production. In this system the standard mold, 10 x 18 in., is subdivided along the 18-in. dimension into eight strips 2 in. wide or multiples thereof. Runners are attached permanently down the centers of the flasks. This allows a length of 4 13/16 in. for each of the previously mentioned 2-in. strips. The occupiable area for patterns on a 2-inch strip is about 1½ x 3½ in. In a 4-in. strip it would be 3½ x 3½ in., etc.

Unit strips are attached by screws to a gray iron plate, and since they are easily removed, only a few minutes are required to take out one unit strip and substitute another. By this method patterns with short runs can be put into or taken out of production as required on the same plate with other patterns having long runs. Standard mold is 2½ in. thick and, allowing 1 in. for molding material, a casting with a total height or depth of 2⅞ in. can be produced. The firm also uses what are termed special molds for larger castings. These are 12 x 20 in., and 4 in. thick. Special castings of larger dimensions also are made.

Castings produced commercially by the plaster molding process can be made to close dimensional tolerances. In general, the height above and the depth below the parting line can be held within plus or minus 0.010 in. up to a total height of 3 in. Width and length of the casting can be held within plus or minus 0.005-in. However, in some cases, depending upon the size and intricacy of the casting, the tolerances may be more or less than the figures given.

Standard molds are produced on a conveyor line, up to a rate of 60 per hour with only one operator; he extracts the plaster mold from the flask and places it on a rack for movement into the baking oven close by. This is possible through arrangement of several automatic devices as will be explained. The conveyor is rectangular in form. Filling the flask takes place at one end, and extraction of the mold from flask and pattern, which are fastened together

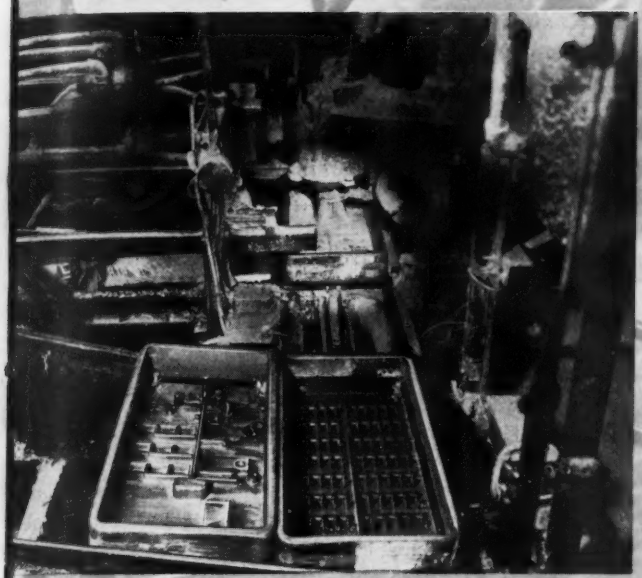
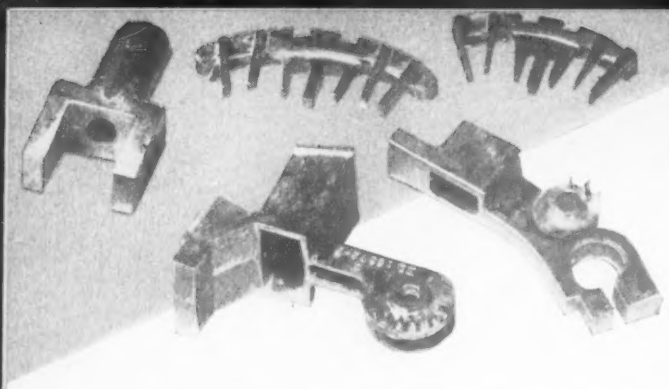


Fig. 1—Center background shows equipment for filling molds rapidly with liquid plaster. Container releasing plaster is equipped with a quick emptying valve

Fig. 2—Dried molds after emerging from the conveyor-type oven are placed on racks and forwarded to the assembly department



permanently, at the other end of the conveyor.

After extracting the mold the operator turns the flask over so that the patterns are face down, and pushes it to a point where it is engaged by the conveyor chain. In approximately the middle of the line, the inverted flask passes over electrically operated spray nozzles which coat the pattern and interior of the flask with an oil-wax-water emulsion. This emulsion is a parting compound which prevents the plaster from adhering to pattern and flask. About 5 ft from the end of the conveyor line the flask passes into an electrically controlled and operated rollover device which brings the patterns face up. At the end of the long side of the conveyor the flasks are picked up by a cross chain and carried across the short end where they are filled automatically with liquid plaster composition.

The filling device is an ingenious arrangement partially shown in Fig. 1. It consists of two revolving cylinders with an electric mixer in each for mixing the plaster and water. The dry plaster and water are both measured automatically and discharged into the revolving cylinders which in turn discharge the plaster slurry into the flasks as they pass the mixing station.

After the flask is filled with liquid plaster composition it moves slowly forward to the extraction station. Travel time from the filling station to the extraction station is sufficient to allow the plaster to harden. In this state the plaster mold can be extracted from the flask with an automatic mold drawing device. After the mold has been drawn from the flask it is placed on a rack with glass shelves. The empty flask is turned over so that the pattern faces down and the flask again starts its journey around the conveyor line.

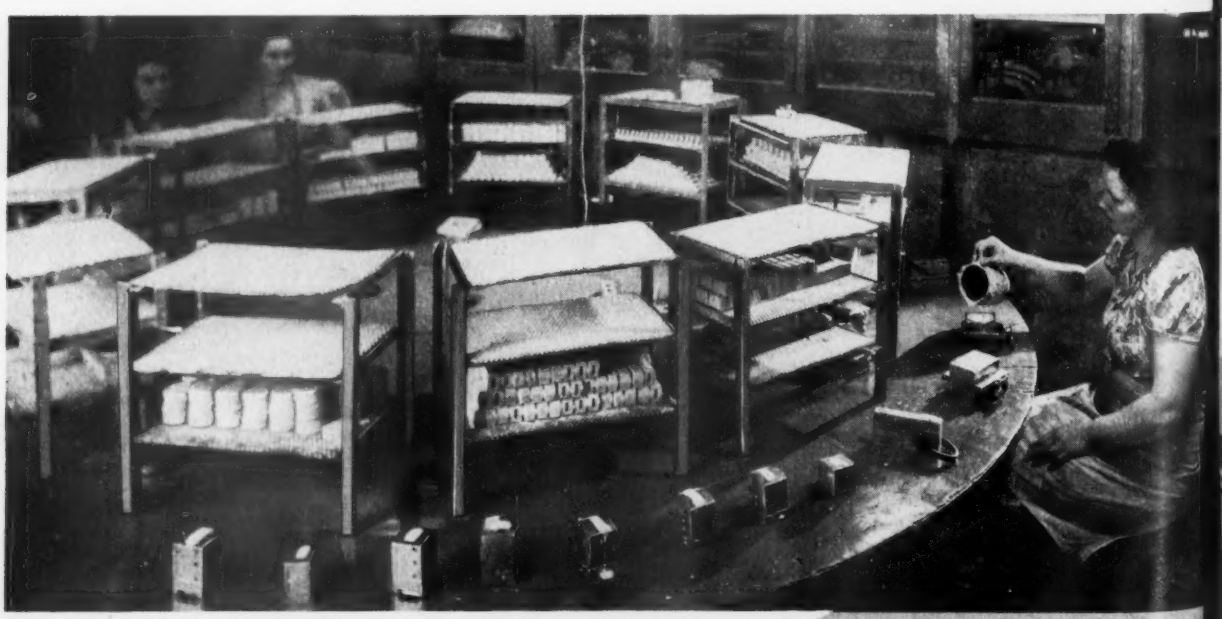
Moist molds, while fragile, are sufficiently rigid to be handled with a reasonable amount of care and are taken from the racks and placed in a gas-fired, continuous-type oven for drying and cooling. The oven carries two rows of molds as indicated in Fig. 2. Time and temperature are adjusted to permit drying and cooling of the mold in approximately 1¾ hours. After the molds are dried they are placed on racks to await assembly.

Reference was made earlier to special molds which are 12 x 20 in. and 4 in. thick for the production of castings either larger in area or total height, or both, than can be produced in standard molds. In these molds castings up to a total height of about 6 in. can be made. While these molds also are produced on a conveyor line, the practice differs in several respects from that just described. Only one side of the conveyor is mechanized to carry the molds from the filling zone to the extractor; the other, or flask return, is a gravity roller conveyor.

Liquid plaster composition for the flasks is mixed in small batches sufficient to fill a flask. The flask is mounted on a specially designed jolting machine, and after being filled with plaster is jolted for several minutes to remove any entrained air bubbles and to compact the plaster against the pattern faces. After jolting, the flask is taken from the machine and placed on the mechanized conveyor and transported to a mold extractor similar to that previously described. Following extraction the mold is placed on a rack and the flask returned to the filling end on the roller gravity conveyor. Coating of the flask interior and pattern faces with oil-wax-water separator is performed by hand.

Molds are dried in a furnace similar to that used

Fig. 3—Cores, also made of plaster, are produced on this circular table. After air setting, the cores are removed from the boxes on the opposite side and placed in the racks



for the standard molds except that, due to the larger mold volume, the operation requires a longer period.

Cores are made from the same plaster mix as used for molds, and since the material is used in comparatively small quantities at any given time, it is mixed in small batches. As may be observed in Fig. 3, cores are made by women, and metal coreboxes similar to those employed for sand are used with the exception that dimensional tolerances are much closer. Instead of rectangular, individual benches for core-making, two circular metal-topped tables are used. One of the tables is 12 ft in diameter and the other 8 ft. Similar to the production of molds, the plaster mix in the corebox is permitted to air-set for a short period before being turned out and placed on wood boards in the racks in front of the operators, as shown in Fig. 3.

When the boards are full of cores they are removed to racks on wheels and taken to the core oven located in one corner of the room where they are dried. Following drying the cores are inspected carefully, placed in trays, and taken to the assembly benches for incorporation in the molds. Mold assembly is conducted in booths open on one side only. Equipped with fluorescent lights to provide a high stage of illumination with minimum glare, the booths permit operations to be conducted with minimum eye fatigue.

Previous to assembling the mold the operator carefully inspects the drag mold to see that it is free from any defects. Then the cores, if required, are put in place and the cope added, followed by the insertion of the dowels in each of the corner holes. Dowels prevent misalignment of cope and drag or impingement of cope against cores or high points in the drag in closing the mold. Completed molds then are placed on racks to be transported to the nearby pouring stations shown in Fig. 4.

There are four pouring stations, each holding ten molds. Bottom section of the station is a heavy I-beam on which ten cast-iron bottom boards are attached. Top enclosed section of the station houses ten pneumatic pistons which operate the top or hold-down plates. Pistons are divided into two sections of five each so that, if necessary, one-half of the station can be used. Plates are held down under air pressure and the time of holding varies, depending mainly on the section thickness of the castings. As soon as the sprues become solid, but still are hot-short, they are knocked off.

Pouring sleeves are employed to provide an additional head of metal in the pouring operation, thus insuring well-fed, sound castings. These are made of plaster or asbestos paper depending on whether aluminum or brass is being poured. Metal pourers are well protected against metal splashes.

After the castings have (*Please turn to page* 144)

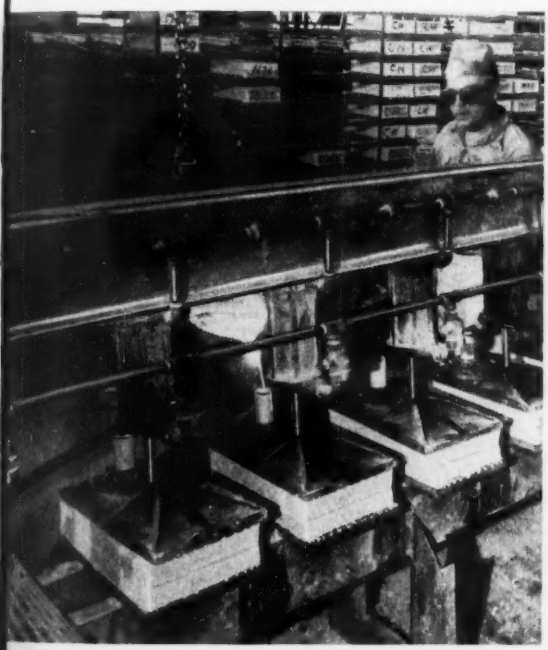
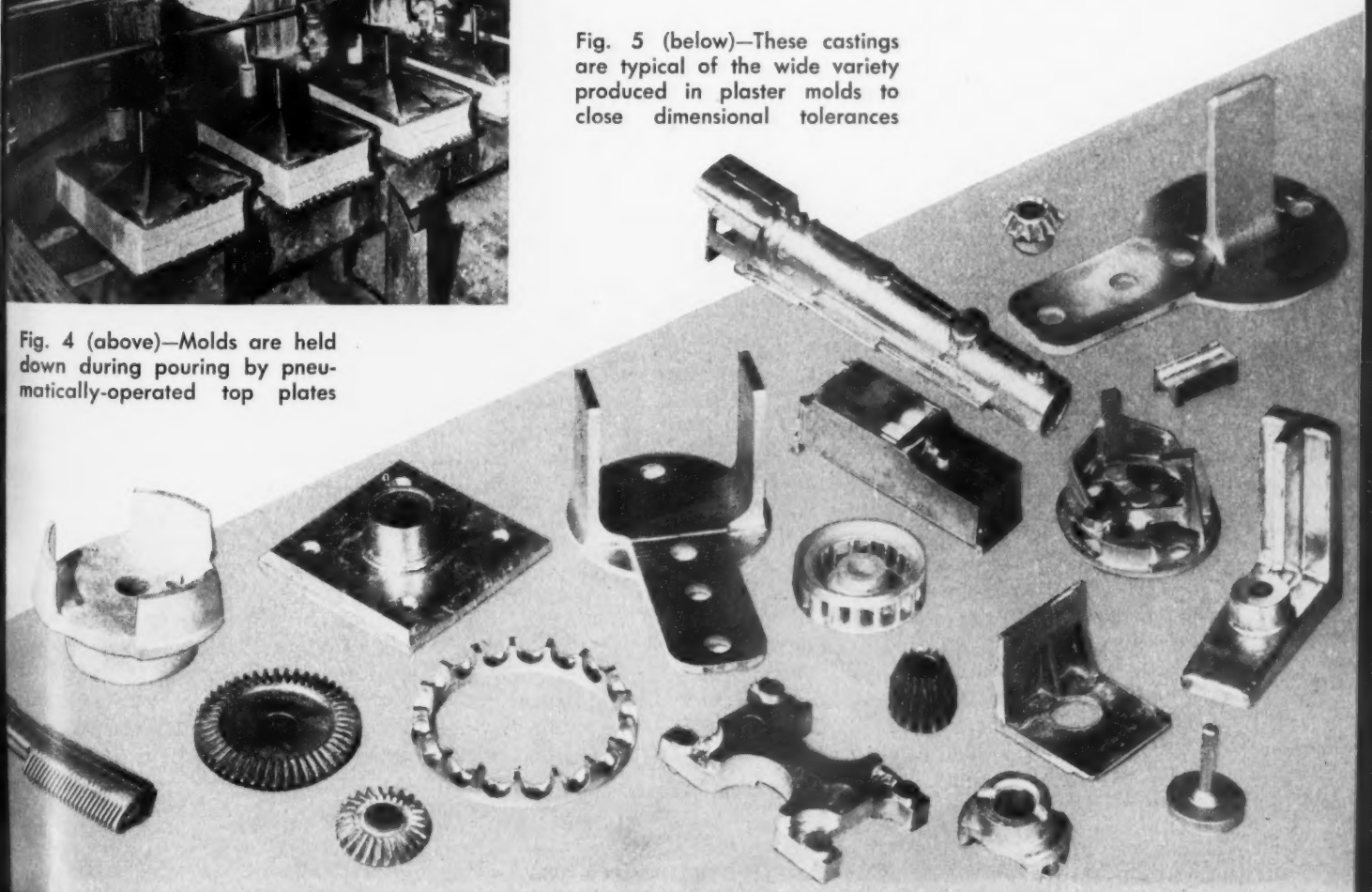


Fig. 4 (above)—Molds are held down during pouring by pneumatically-operated top plates

Fig. 5 (below)—These castings are typical of the wide variety produced in plaster molds to close dimensional tolerances



This is a story of how product engineering by a steel foundry converted a car-trailer attachment from a weldment to a casting assembly of greater strength, lower weight and cost and improved appearance

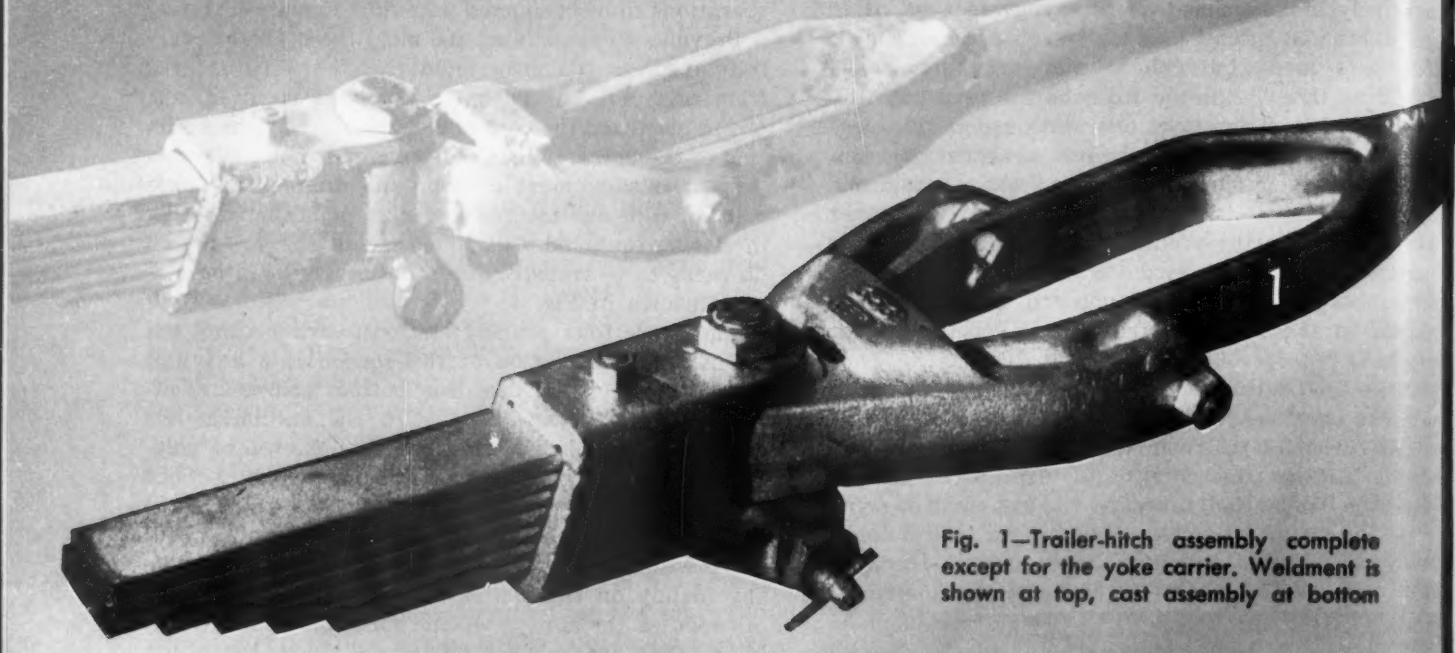


Fig. 1—Trailer-hitch assembly complete except for the yoke carrier. Weldment is shown at top, cast assembly at bottom

CONVERSION TO Castings

RESULTS FROM FOUNDRY ENGINEERING

HOW intensive emphasis on product engineering pays off in the steel casting industry is outlined convincingly in a product development report taken from the files of the Steel Founders' Society of America.

It comprises an example of how sound foundry engineering keyed to customers' needs can be made to pay measurable dividends in terms of lower cost, higher quality and improved buyer-supplier relationships. It is a story with a hitch in it. In fact, the hitch makes the story, and it could be told briefly this way:

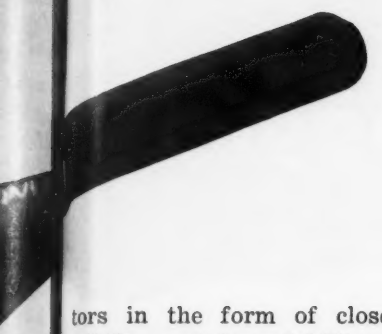
Foundry-engineered redesign of a trailer-hitch unit, which began with consideration of how to achieve required improvements in a single part, and culminated in redesign of all four parts and development of a completely new assembly, by means of which a small manufacturers' sales were materially increased.

The steel foundry, Unitcast Corp., Toledo, entered the picture after the inventor and manufacturer had completed basic design and a welded pilot model of the so-called Tour-Aid assembly, a car-trailer attachment of advanced design. Using weldments, mechanical success of the pilot model seemed assured, and the manufacturer began to figure production costs, sales appeal and qualifications such as durability.

Although the weldments served the purpose for experiments, it became apparent that the manufacturer was far short of answering any of his marketing problems. The assembly was sadly lacking in eye-appeal, which inevitably affected its sales appeal.

This deficiency in appearance applied particularly to the tow-bar pinion unit (shown as weldment and steel casting, respectively, in Fig. 2). As a weldment, the part looked "home-made." Too many individual pieces had to fit together, representing time wasted in fabrication and leaving a wide margin of error; also, service dependability was questioned.

Thereupon, the manufacturer called into consultation the steel foundry's engineers and dropped the problem into their laps. The result was redesign of the tow-bar pinion part for production as a steel casting, with smartly improved finished appearance necessary for consumer sales, and other plus-fac-



tors in the form of close dimensional tolerances, solidity and dependability.

But the story didn't end there. Acting on the manufacturer's suggestion, the foundry engineers proceeded with engineering analysis of other parts forming the complete trailer-hitch assembly. Here again, redesign effected dollar-and-cents improvements, with subsequent conversion of three other previously welded parts to steel castings as illustrated: Pinion yoke piece (Fig. 3); rear yoke part (Fig. 4); and yoke carrier (Fig. 5).

All-around improvement gained by the manufacturer in better appearance and enhanced sales appeal is graphically illustrated by the unit shown in Fig. 1. This is the completely converted trailer-hitch assembly except for the yoke carrier part which in actual use is fastened to the trailer tongue under the trailer's rear section to firmly seat the rounded supporting member of the rear yoke piece.

Other advantages gained through redesign conversion in this instance, as reported by Unitcast, included substantial cost reduction, reduced machine work and elimination of misfits. Total weight of castings was 5 per cent less than that of the original welded units; total finished cost of steel castings was about 20 per cent less than weldments; and machining costs on steel castings were around 75 per cent less than for weldments.

As for strength factors, a laboratory report rounds out the story:

"Rear yoke casting (T-Loy alloy)—normalized. Casting was blocked on extreme ends with compression load applied on the Y-section. Casting showed no deformation up to 8000 pounds load. Deformation of 1/32-in. experienced where additional 1000 pound load was applied after 8000 pounds, up to 12,000 pounds. Same part in fabricated form, under identical testing procedure, started to bend at 1500 pounds, and was not usable for further test purposes due to permanent deformation."

Additional test was made of the complete assembly made up of steel castings, with the following report:

"Assembly was blocked at the spring fab section of channel and extreme end of rear yoke casting. Compression was applied at point of standard ball point loaded at 12,000 pounds. Entire compression load was taken up in the spring section fitted into the casting. No test beyond 12,000 pounds was considered necessary."

Through complete redesign of the trailer-hitch, the small manufacturer enjoyed unprecedented sales inquiries in an off-season; and the responsible steel foundry was able to build a small part volume on production orders for four parts instead of one—or none.

Fig. 2—Tow-bar pinion. Welded part at top, casting at bottom. Fig. 3—Pinion yoke, with casting shown at left. Fig. 4—Rear yoke part, showing casting below. Fig. 5—Yoke carrier (casting above) in service is fastened to tongue under the trailer's rear section

THE ACCOUNTANT Reports t

For most effective use, reports to foundry executives must be thoroughly comprehensive, accurate and timely, but simple to understand. Various types of report forms which fill these qualifications are described here

DESIGNATION OF COLUMNS — DATE _____

A 60% OF NORMAL OPERATION
B 70% OF NORMAL OPERATION
C 80% OF NORMAL OPERATION
D 90% OF NORMAL OPERATION
E 100% OF NORMAL OPERATION
F TWO SHIFT OPERATION
G THREE SHIFT OPERATION
H

	A	B	C	D	E	F	G	H
1 MATERIAL (DIRECT)								
2 LABOR (DIRECT)								
3 OVERHEAD (VARIABLE)								
4 TOTAL PROCESSING								
5 TOTAL VARIABLE COST								
6 FIXED EXPENSE								
7 TOTAL MANUFACTURING								
8 MARKETING								
9 TOTAL OPERATING								
10 USE OF CAPITAL								
11 TOTAL								

SUBJECT OPERATION—NAME

Fig. 1—Form for preparing normal costs for each operation commonly used in estimating jobs

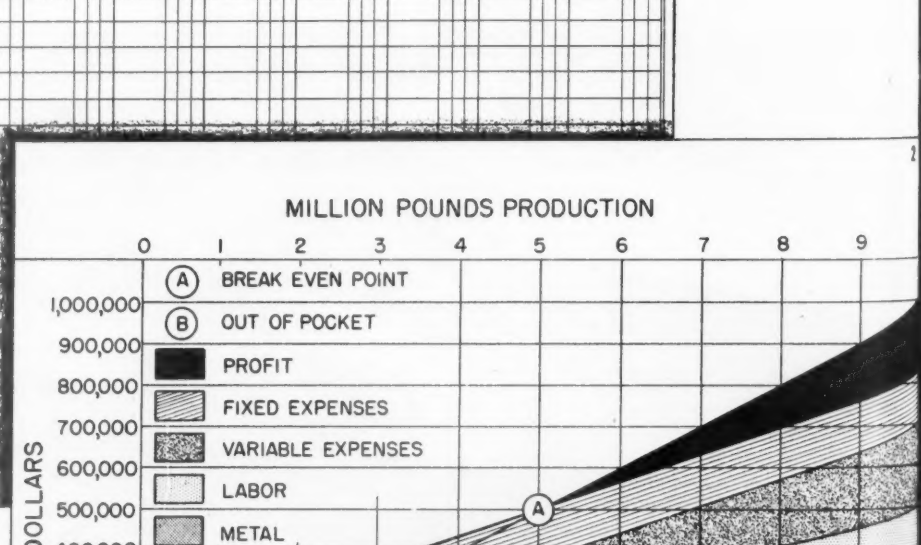


Fig. 2—Chart used to arrive at break-even and out-of-pocket points

tManagement

By ALBERT E. GROVER
Cost Consultant
Cleveland

WHILE the purpose of business is service, its existence cannot continue indefinitely without profit. Profit can only be realized when there is good merchandising; and good merchandising must be predicated on knowledge of the potential market, intelligent and accurate cost information, and a goodly amount of intestinal fortitude in the establishment of sales policies.

No matter how busy an executive is, he must devote a considerable portion of his time to a consideration of company profits. He must determine the source of these profits as well as their size in order to shape intelligently the best policies for his particular business. To do this, he must satisfy himself that the costs and other statistical information furnished him are fundamentally sound.

Of vital importance to the individual foundry executive is the type of competitors bidding against him for business. Let us classify them into these types:

1. The foundryman who does not know his costs and is frank enough to admit it.
2. The foundryman who does not know his costs but thinks he does.
3. The foundryman who knows his costs and is in a position to know that he knows, having obtained this position by careful study of his costing methods to see that they are in keeping with sensible practices.

Unless the cost system is based on sound principles, sales prices must necessarily be inaccurate and a menace, not only to the individual foundryman, but to the industry as a whole.

In reporting to management, it is important to determine: What reports are required; items that should be embodied in the report; to whom the report should be given; how often the reports should be made, and how management should treat the reports.

Two major types of reports are:

1. Status of the business at any particular time.
2. Gains or losses as a result of operating the business.

Status of the business is usually shown on the balance sheet. The effective balance sheet shows in one complete picture, the financial state of affairs in the business. It not only tells how strong or how weak the business may be financially, but it reveals, also, the particular parts or places where the strength or weakness lies.

Gains or losses as a result of operating the business should be incorporated in statements showing:

1. Income from sales of the company's product.
2. Operating costs required to manufacture and market these sales.
3. Gains or losses and reasons for the differentials from the expected amounts.

Something about cold print and figures makes some business men shy away from them. Sometimes these figures seem difficult and uninteresting. They seem to lack the life that is in the picture, or the human interest one will find in a well written story. Therefore, reports to executives must be thoroughly comprehensive, accurate, timely and simple to understand.

The executive is a busy man, and when he needs many facts, he usually wants them served in a nutshell. He can hire the brains, for a reasonable sum —brains that will throw away the hulls; but he can't always hire the brains that will use the kernel of fact to the best advantage, once it is discovered.

To produce castings a company must have operat-

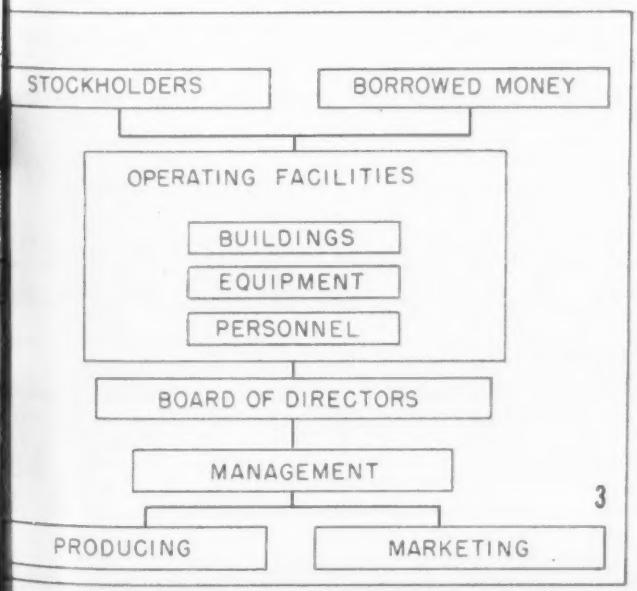
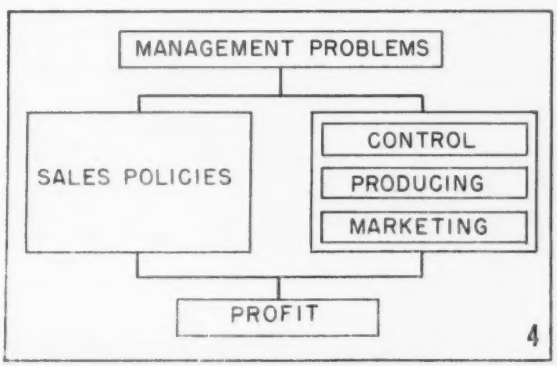


Fig. 3—Foundry operating facilities must be provided by either stockholders or borrowed money

Fig. 4—Two major classes of management problems



ing facilities consisting of buildings, equipment and personnel. These facilities are furnished by either stockholders or borrowed money (Fig. 3).

Custody of the operating facilities being vested in a board of directors, it becomes necessary to select certain members of the board or others, to manage the business. Let us consider them as "top management." Certain individuals of top management may devote their activities either wholly, or in part, to the control of producing or marketing castings.

In certain small foundries, the top management may consist of a single individual who controls all the activities of the company, whereas in larger companies it becomes necessary for top management to delegate specific controls to other individuals.

Management problems may be divided into two major classes (Fig. 4)—first, the establishment of sales policies and, second, the control of producing and marketing castings.

In establishing sales policies, it is necessary to solicit business and accept orders for castings the foundry is equipped to produce efficiently, and which will either return a profit on capital invested in operating facilities, or, in periods of low industry production, recover wholly, or in part, the fixed cost of operating the foundry. To accomplish this it is necessary that certain basic cost principles be adhered to.

Frequent changes in volume requirements caused by economic business conditions (beyond the company's control) make it advisable for each foundry to establish sales policies based on costs calculated on normal operation. (See "Establishing a Normal Operation in a Gray Iron Jobbing Foundry," August, 1947, FOUNDRY.)

The fact must be accepted that there will be no restriction placed on companies who may bid for business below the break-even point. (See "Establishing a Sales Policy for Jobbing Foundries," March, 1945, FOUNDRY.) Therefore, the wise management will see to it that it enters competition with a scientifically prepared basis for establishing a sales policy for each item to be produced, so as to be in a position to select the work that is most profitable, considering the particular operating facilities of its plant. Furthermore, to stay in business the company may be compelled to meet competition at a price that cannot possibly return a profit on its invested capital nor recover all of its fixed expenses. Therefore, it is extremely important that estimating bases be so established that quotations of prices will be above the out-of-pocket line.

Fig. 2 is a chart designed to illustrate a method of arriving at the break-even and out-of-pocket points. On this chart the several elements of cost are segregated as to variable and fixed, as shown by the different sections.

Variable elements are those which fluctuate to a large extent with the volume produced, while fixed elements are not influenced greatly by production volume. However, in actual practice there may be certain expenditures in the variable class that should be treated as fixed, and some expenditures in the fixed class should be treated as variable. Only careful analysis of actual conditions in the individual company will determine what, if any, deviation from the usual classification should be made.

It is assumed, in this illustration, that the normal output of the company is 10 million pounds. Total operating cost is $800,000. The going market price is 9 cents per pound or $900,000 for the entire output. Should the company, as a result of ineffective merchandising or other cause, fail to secure the normal output of 10 million pounds, with the market price and the fixed operating costs remaining constant, the profit would decrease as shown by the chart. The break-even point, approximately 5.6 million pounds, is where the company just recovers its operating expenses from its customers.

Projecting the sales line, at 9 cents per pound, to the point of no production, it crosses costs at 1,600,000 pounds, the out-of-pocket point, or the point where bidding *must* stop, otherwise the company will lose expenditures caused by acceptance of the business.

In establishing a sales policy, or the price the company wishes to make in competition, it is quite convenient to have estimating bases at hand, thus allowing speed in preparing estimates.

Using a form as shown in Fig. 1, the normal costs are prepared for each operation commonly used in estimating jobs, leaving a minimum to be prepared for

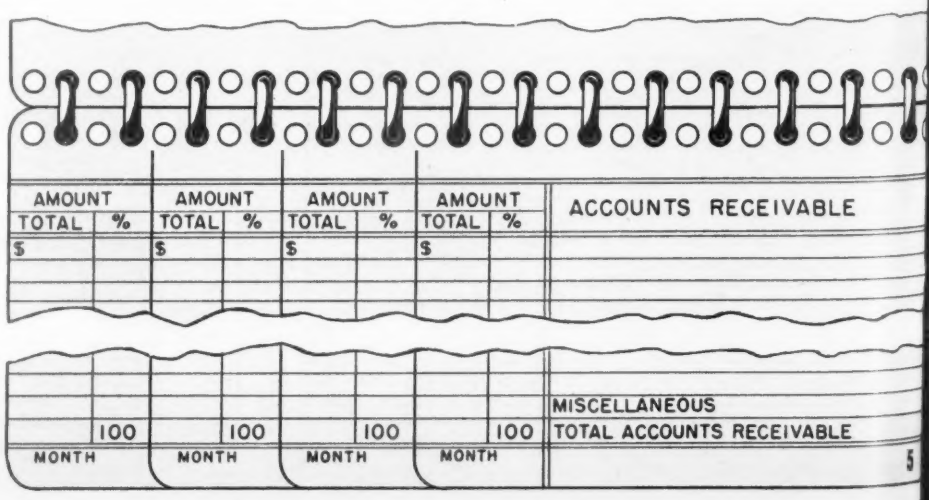


Fig. 5—Form for recording detailed items of the condensed balance sheet

Fig. 6—Report form useful for many of the company's activities

BUDGET		(MONTH)		(MONTH)		(MONTH)		SUBJECT	FROM ___ TO ___	
TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT		TOTAL	UNIT
										6

BUDGET		SUBJECT	FROM__ TO__		FROM__ TO__		FROM__ TO__		FROM__ TO__	
TOTAL	UNIT		TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT
7										

Fig. 7—A method of making quarterly reports

AMOUNT		AMOUNT		AMOUNT		AMOUNT		BALANCE SHEET
TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	
								ASSETS
$		$		$		$		CASH
								ACCOUNTS RECEIVABLE
								NOTES RECEIVABLE
								INVENTORIES
								PREPAID EXPENSES
$		$		$		$		TOTAL CURRENT ASSETS
$		$		$		$		LAND
								BUILDINGS
								EQUIPMENT
$		$		$		$		TOTAL FIXED ASSETS
$		$		$		$		TOTAL ASSETS
								LIABILITIES
$		$		$		$		ACCOUNTS PAYABLE
								NOTES PAYABLE
								ACCRUED PAYROLL
								ACCRUED EXPENSES
$		$		$		$		TOTAL LIABILITIES
								CAPITAL
$		$		$		$		CAPITAL STOCK
								SURPLUS
								UNDIVIDED PROFITS
$	100	$	100	$	100	$	100	TOTAL CAPITAL
$		$		$		$		TOTAL LIABILITIES & CAPITAL
MONTH BUDGET		MONTH		MONTH		MONTH		8

Fig. 8—Lapped sheets aid in comparing principal elements of assets, liabilities and capital

AMOUNT		AMOUNT		AMOUNT		AMOUNT		CASH
TAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	
		$		$		$		CURRENCY
		$		$		$		IN BANKS PAYROLL DEPOSITS (NAME OF BANK)
								" " "
								" " "
		$		$		$		TOTAL PAYROLL DEPOSITS
		$		$		$		OTHER DEPOSITS (NAME OF DEPOSITORY)

	%	$	%	$	%	$	%	
								TOTAL OTHER DEPOSITS
	100	$	100	$	100	$	100	TOTAL CASH
MONTH BUDGET		MONTH		MONTH		MONTH		9

Fig. 9 — Showing breakdown of main cash items

Fig. 10—Showing use of for for recording inventories various raw materials

Fig. 11—Lapping of stateme sheets allows for ready co parisons of the profit and lo elements

Fig. 12 — Arrangement permitting comparisons of entire year's transactions

Fig. 13—Form for individual customers

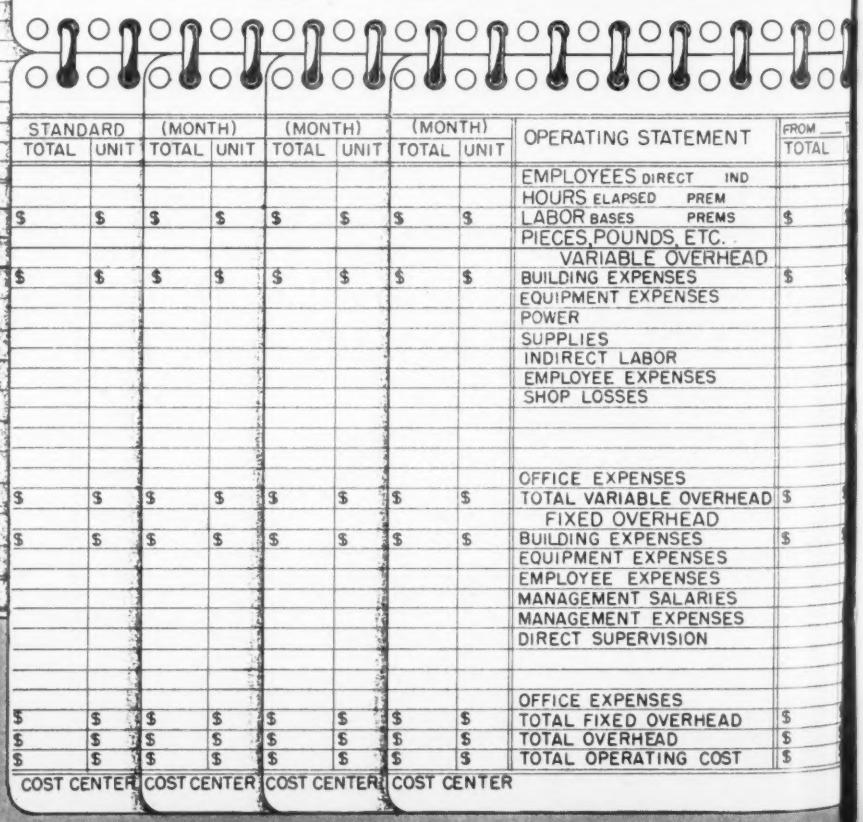


Fig. 14—Method of reporting statistical and cost information by cost centers

other jobs. It will be noted that the unit cost is recorded for different volumes of business, as well as broken down into major elements of cost. Some companies which produce all or some standard units will want to predetermine the costs of completed sales units. This may be accomplished by using the form just mentioned.

Some reports and statements are so cluttered up with detail the management will not take the time to perform an "autopsy" to discover what, if anything, is wrong.

Some reports and statements are prepared without enough uniformity to assist management to find out what they want and need in the shortest time. To be of most value to management, operating reports should be:

1. Sufficiently accurate to be dependable.
2. Timely.
3. In enough detail to analyze intelligently the various activities of the business and with either budgeted or established standards.
4. In such form that cost elements may be quickly compared by periods and with either budgeted or established standards.

Shown here is a group of reports of this nature. This form of report (Fig. 6) may be used effectively for many of the company activities.

The reports are 6⅜ x 8½ in., punched with 5/16-in. holes, 2/8-in. center to center and ⅜-in. from the top of the sheet. In this form the individual report sheets are lapped in a 11 x 8½ in. multiple binder so that the costs and other statistics of each detail of a particular subject may be compared quickly with a predetermined budget as well as each month with the other months in the quarter year.

Both "Total" and "Unit" costs are visible. This is a marked advantage over the customary method of report costs and other statistics for the month on a single folder which requires recapping if comparisons are to be had.

When the second month of the quarter year is placed in the binder, the costs and some of the other statistics for the first and second months are added and the sum entered at the right of the second month's sheet, and new cumulative unit costs calculated and entered.

At the close of the third month in the quarter the costs and some of the other statistics for the month are added to the cumulated figures at the close of the second month, entering the sum at the right of the third month's sheet. The unit costs are calculated and entered.

Printed blank forms may be used as there are several different reports that use the same form. This would require typing or duplicating the details. If the company desires, the report with subject and details may be printed for each subject.

There is a marked trend toward quarterly reporting. This method of reporting may be accomplished very efficiently by removing the reports for the third month of the quarter for the binder and placing it in another section with the cumulative figures visible at the right of the binder (Fig. 7). Thereafter placing the succeeding last month's reports backwards so that the cumulative figures are visible and immediately adjacent to the previous quarter. Thus quarterly figures may be compared with each other in the year, also with an established quarterly budget or standard.

Fig. 8 shows how the lapped sheets aid in comparing the principal elements of assets, liabilities and capital. Executives of the foundry are interested first in the status of the business in a condensed form to ascertain if there are items that are out of line with the normal trend of the business. This can be done quickly by this method of presentation. Should any items indicate further study, the details supporting it are recorded in a like manner to condensed balance sheet, on subsidiary record sheets, as illustrated in Figs. 5, 8, 9 and 10.

Fig. 11 shows how the profit-and-loss statement sheets may be lapped in the multiple ring binder to allow for ready comparisons of the several elements. The form is designed for use where standard costs are kept. The costs of sales are at standard.

The "Operating" section showing variances which are differences between actual and standard costs of the product shipped. Foundries working on an actual cost basis would not need this section of the statement.

Interest on investment in costs, which some foundries include in overhead, is shown as a nonoperating item. However, companies not including interest on investment in overhead would have no need for this item on the statement.

The depreciation variance is the measure of differences in depreciation calculated on actual investment costs and depreciation calculated on physical property values other than actual investment cost.

These statement sheets are filed in the multiple ring binder for monthly comparisons and at the end of the quarter filed from right to left for quarterly comparisons, as explained in Fig. 7.

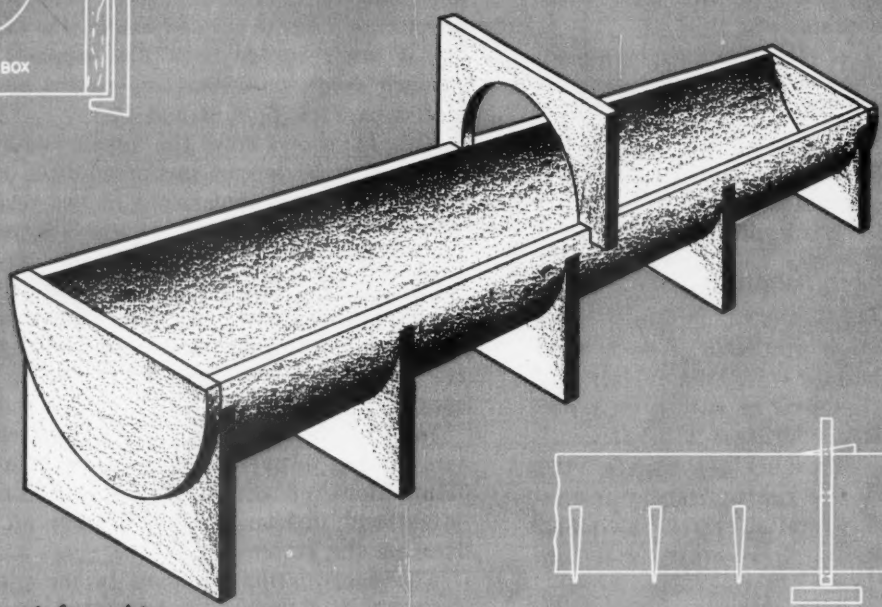
Fig. 12 shows an arrangement of sheets in the multiple ring binder so that comparisons may be made of the entire year's transaction. A line is provided at the top of the sheet for entering the monthly budget and a similar line at the bottom of the sheet for the annual budget. This method of arrangement of sheets is usable only where there is a limited number of elements.

This report, "Analysis of Sales and Profits by Parts," (pattern numbers may be substituted for parts) gives a simple analysis of pieces shipped; net sales; costs of the pieces shipped, expressed in standard and actual; profits at both standard and actual, expressed in both amounts and percentages. The report is very useful to management in showing statistics and profit for each part shipped. This form of reporting provides for a complete history of sales and profits for the entire (*Please turn to page* 202)

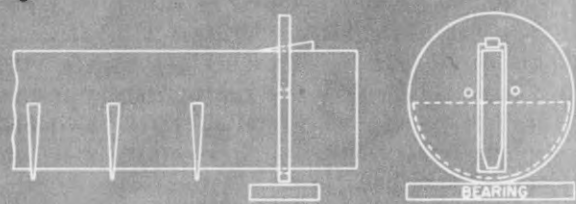
Pipe Molding Method

By PAT DWYER
Engineering Editor
FOUNDRY

Core supported in green sand bed



Upper half of core is formed in this metal corebox by a strike

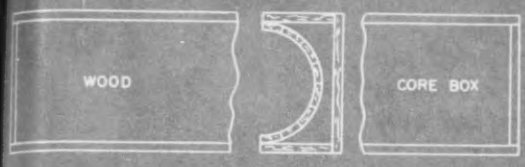


Side and end view of cast iron arbor

A RECENT inquiry from a reader on the subject of flanged cast iron pipe prompted a longer than usual reply. Loam cores were employed at this plant in casting pipe 4 to 10 in. in diameter and 8 ft long. The pipe forms part of a manufacturing program and is cast in small lots, two to six in a heat. The inquirer wanted to know if there is not a better or more economical method for making the cores.

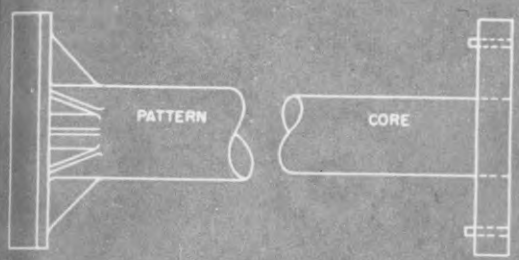
Cores for cast iron pipe are made according to several methods, depending to a considerable extent on available material and rigging, and perhaps to a greater extent on the daily tonnage. Where large quantities are cast in regular pipe foundries, loam cores are employed exclusively. This applies to long pipe cast vertically in dry sand molds. In one notable exception a system was developed several years ago for casting similar pipe in green sand molds with green sand cores. Soil pipe and pressure pipe, flanged at both ends and up to 6 ft in length, are molded and cast horizontally in green sand molds with green sand cores. The cores are swept on barrels of either heavy steel or cast iron. For a plant which already has such barrels we are inclined to the opinion that the practice of employing loam cores is the best and most economical.

Universal practice among pipe makers in producing cores is to use either hay rope or a special corrugated paper strip. The tightly wound rope is covered with a coating of coarse, open-grain sand, known in the foundry as loam. The main coating is ordinary black or used sand mixed with water to the consistency of mud. The finishing coat usually is a thin new sand slurry. The cores are black washed

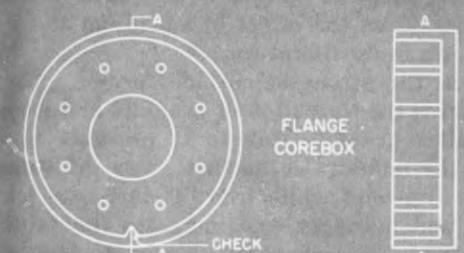


Showing construction of half corebox

Core dried in halves and then pasted



Improved type pipe pattern and core



Bolt cores are pasted in flange core

while still hot as they come from the oven.

The following coremaking methods first are outlined briefly and then expanded to some extent.

1. Two half cores are made in a plain corebox. After they are dried they are matched, calipered and pasted. Each half is reinforced with long rods or steel pipe. In the larger sizes it is advisable to tighten a strand of wire around the core about a foot from each end. The wire may be exposed, or covered in a shallow groove. For ordinary rough castings the method is satisfactory, but it is practically impossible to make a perfectly round core, especially in the large sizes.

2. Bake one-half the core. Ram a second half in the box. Place dry half on green half and roll over. For longer cores—say over 4 ft—an iron stud of some kind will be needed in the center of the green section as a support for a chaplet.

3. Place about 1 in. of core sand in the bottom of the wood corebox. Rap a suitable length of steel pipe down in the sand. Ram sand into the space between pipe and sides of the box. Build sand on top of pipe and scrape away the surplus with strike. The strike has a semicircular opening, and the lower ends ride on the upper edges of the corebox. Place a frame around the core and fill it with molding sand. This will serve as a support when the assembly is clamped and rolled over.

4. Use an iron corebox and let the core remain in the box until it is baked. It may be advisable to line the box with paper to prevent the core from sticking.

5. Green sand core may be swept on a barrel. The barrel revolves between two centers and the sand falls in a thin stream from an overhead hopper. A fixed straight edge cuts the face of the core to the proper shape and size. Provision must be made for a chaplet on the upper side.

6. Green sand core reinforced with a cast iron arbor equipped with heavy, rigid central member, a circular plate at each end, attached with wedges, and half wings spaced about 6 in. apart on each side. With typical cast iron arbors a long, 1-in. steel rod or brass tube is laid on top of the arbor wings and close to each side of central member. The rods or tubes are pulled out of the finished core and leave vent openings.

Loam cores are made by daubing a thickness of wet loam or mud over a hay, straw or paper covered iron or steel tube known locally as a barrel or arbor. This style of core presents many advantages, but whether the claim is justified from a daily cost standpoint depends on several factors. For example, loam cores are used exclusively in all the pipe shops where the castings are poured in a vertical position and where duplicate castings are made in large numbers. Original cost of the arbors and other rigging is absorbed rapidly. Manifestly, a different set of conditions obtains when the castings are poured horizontally and when are made in only small numbers.

Another feature which must be taken into consideration is that a loam core cannot be made from just any kind of sand that happens to be convenient. This applies particularly to the finer grades. Unless a suitable grade already is in use in the foundry, it is an open question whether economy would be served by ordering a special supply for making a few cores per day. Artificial loam may be compounded from various mixtures of fine sand, claywash and sharp sand and sawdust. Here again the question of cost enters since mechanical mixing equipment must be provided and operated. A natural loam sand which requires no "doctoring" is available in several localities.

Assuming that conditions warrant the use of loam cores, the following brief description outlines the equipment, methods and materials. For simplicity the description will be confined to one unit, rather than to pipe in quantity. A 5-in.-OD barrel is required for an 8-in.-ID casting. This will allow for a single thickness of ¾-in.-diameter hay rope and a ¾-in. thickness of loam. (*Please turn to page* 220)

Tests to determine the properties of castings made with an imported pig iron produced by the charcoal-electric process are described here. This iron contains considerable amounts of vanadium and titanium but only small quantities of phosphorus and sulphur

"White Coal" PIG IRON

Fig. 1—Chill tests. Sample at left contains relatively low V, high C and Si. Sample at right has low Si

By E. K. SMITH
Consulting Metallurgist
Los Angeles

CHARCOAL pig iron has always had distinct advantages in the gray iron foundry. But when the electric furnace is substituted for the conventional blast furnace, and charcoal is used for reduction, the pig iron has interesting metallurgical possibilities, especially when the ore is of unusual purity.

The pig iron in question also contains considerable vanadium and titanium, coupled with very low phosphorus and sulphur. It was therefore deemed of interest to determine the practical effect of the substitution of such pig for standard pig iron, in high-grade gray iron practice, both in cupola and electric furnace.

Literature—Since the alloy content of this pig iron would have a strong effect on the physical results obtained, a search was made of the literature, particularly on the effects of vanadium and titanium on cast iron. The information on these alloys is thoroughly and authoritatively summed up in the *Alloy Cast Iron Handbook,* second edition, 1944, published by the American Foundrymen's Society. J. W. Bolton, in his book *Gray Cast Iron,* Penton Publishing Co., 1937, pp. 206-208 also sums up the effects of these alloys.

McElwee and Barlow published an interesting article on "Vanadium in Gray Iron Castings" in FOUNDRY, December, 1944. This paper contains much information of a practical nature, especially that on the use of vanadium in parts subjected to wear, and in heat treated castings such as dies.

Schneidewind and McElwee presented an exhaustive paper on "Composition and Properties of Gray Iron" before the AFS, 1950, Preprint 50-38. In this paper they demonstrate that vanadium increases the strength of cast iron more than does any other alloy. (pp. 10-11).

Jean Challansonnet presented much interesting information in "Norwegian Pig Iron With Titanium-Vanadium." He also presents a bibliography. (Published by A/S Bremanger Kraftselskab, Bergen, Norway.)

It may be pertinent to present a very brief digest of the information on the effect of vanadium and titanium, as shown in the literature.

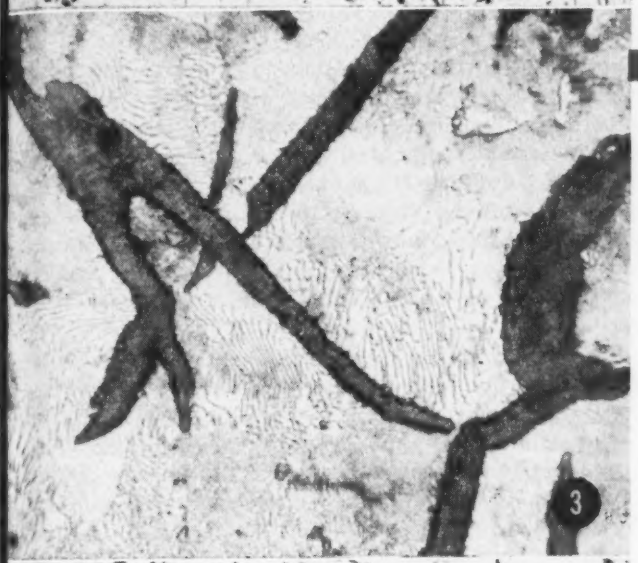
Vanadium is the strongest carbide former. This, of course, retards the formation of graphite and tends to make smaller graphite flakes. It prevents to a great extent the undesirable dendritic type of structures in gray iron and white iron. It increases tensile strength and hardness, and increases the "stiffness" of the iron. On account of its carbide forming properties, it is widely used for imparting resistance to wear and growth at high temperatures. It is often used with other alloys such as molybdenum, nickel, chromium or copper.

Titanium is a strong graphitizer and scavenger and tends to combine with oxygen and nitrogen. It reduces grain size and graphite size. It is often used with carbide-forming elements such as chromium and vanadium.

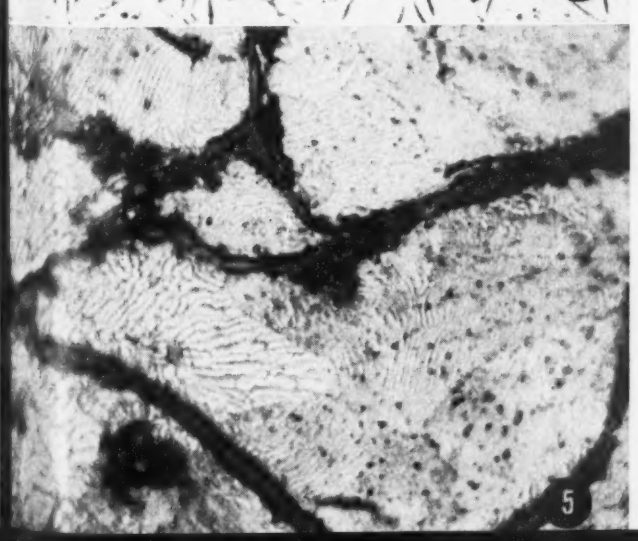
It might be pointed out that, in certain parts of the literature, there is a tendency to judge the various alloys only by their effect in increasing tensile strength. This is in some cases an error, as the main use of alloys today is to obtain some specific property in the castings for specific services. For example, while alloys may be used to increase strength, either tensile or transverse, they also are employed to resist corrosion or the effects of high temperatures, or to increase resistance to wear, or even to give super-machinability.

Experimental Tests — Numerous test melts were made under commercial conditions, a 72-in. cupola being used. Proportions of the vanadium-titanium pig iron were varied according to the castings being

Figs. 2-3—Series A test bar microstructures. Fig. 2 unetched, X100. Fig. 3 etched, X1000



Figs. 4-5—Series B test bar microstructures. Fig. 4 unetched, X100. Fig. 5 etched, X1000



poured.

The alloyed pig iron used was obtained from A/S Bremanger Kraftselskab, Bergen, Norway. It is sold under the trade name Vantit pig iron. Its analysis follows: C 3.60 to 4.00 per cent, Si 1.50 per cent, Mn 0.50 per cent, P 0.025 per cent max, Su 0.025 per cent max, V 0.60 per cent, Ti 0.30 to 0.50 per cent.

The very low sulphur and phosphorus are due to the purity of the ore and to the fact it is reduced with charcoal in electric furnaces.

To maintain close control of the iron, chill tests were poured from each ladle. Fig. 1 shows two of such chills. The one on the left contained relatively low vanadium, with high carbon and silicon, while the one on the right was for a heavy casting and contained low silicon.

The chill tests shown in Fig. 1 illustrate the extreme ranges which might ordinarily be required with vanadium-titanium iron. The test on the left corresponds to 197 brinell hardness number, the one on the right to 241 brinell.

Experimental Series A—The first set of trial cupola charges consisted of:

150 lb Vantit pig iron	12.5%
150 lb regular pig iron	12.5
400 lb machinery cast iron scrap	33.3
500 lb steel rails	41.7
1200 lb	100.0%

One-third of the silicon was added at the spout as an innoculant. Vanadium charged was 0.07 per cent and titanium charged was 0.05 per cent, both as Vantit pig. Test bars were poured and tested in accordance with ASTM Specification A 48-46, Bar B. Tensile tests were run on machined ends of transverse bars, and brinell hardness was taken on the same bar.

Physical properties and chemical analysis of Series A follow:

Transverse test—0.121-in. deflection of 12-in. span, 1.231-in. diam, under 4040-lb maximum load. Tensile strength 37,000 psi; brinell hardness (3000 kg) 217; modulus of rupture 71,820. Chemical analysis—TC 3.68 per cent, Mn 0.75 per cent, P 0.21 per cent, S 0.089 per cent, Si 1.89 per cent, Cr 0.32 per cent, Mo 0.42 per cent, V 0 08 per cent, Ti 0.00 per cent.

The microstructure of Series A bars was distinctly

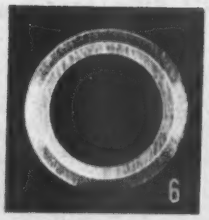


Fig. 6 — Wear test on cylinder made from Series C cast iron

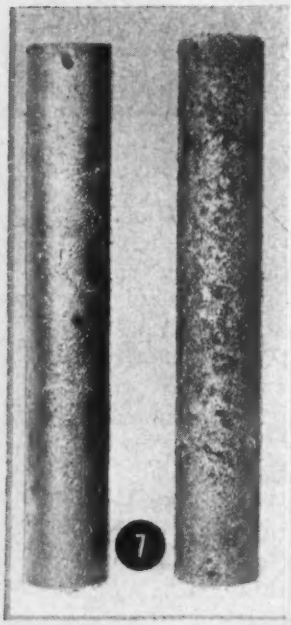
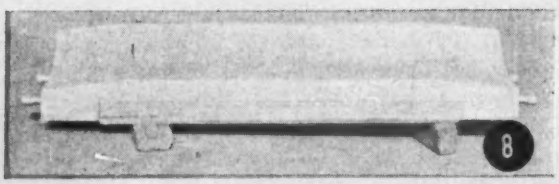


Fig. 7 — Oxidation test. Bar at left contained 12½% V-Ti pig. Bar at right had no V-Ti

Fig. 8 — A die casting made with V-Ti pig



"fine grained." At 100 diam, unetched (Fig. 2), the graphite flakes are seen to be distinctly short, with a length corresponding to ASTM Size 5, or ¼ to ½ in. maximum at 100 diameters magnification. The graphite is of Type A, uniform distribution, random orientation. All references to graphite sizes and types are from ASTM 1946 *Book of Standards,* Part 1-A, Tentative Recommended Practice for the Evaluation of the Microstructure of Graphite in Gray Iron. No. A-247. Graphite Flake Size Chart and Graphite Flake Type Chart.

Photomicrograph of Series A bar at 1000 diam, etched (Fig. 3) shows an excellent structure consisting entirely of pearlite and short, thick flakes of graphite.

Series B—Owing to the unusually good structures of Series A test bars and castings, and to the very smooth machined surfaces obtained, a sample was procured from iron poured from the same cupola, the mixtures being identical, except that no Vantit pig iron was melted. This mixture contained the same amount of alloys and other constituents as Series A, and is a mixture which has given satisfactory results for years. Figs. 4 and 5 show the structure of this iron.

Fig. 4 shows Size 4 graphite, longest flakes ½ to 1 in. The graphite is again Type A, uniform distribution, random orientation.

The striking difference between Series A with Vantit pig iron, and Series B, without it, is the fine graphite in the iron containing vanadium and titanium. Fig. 5 shows the good pearlitic structure, but the graphite flakes are longer and thinner than in Fig. 3. The graphite structure has a great effect on the performance of cast iron, particularly on its resistance to impact, wear, etc.

Series C—Because of the favorable results obtained in Series A, where the cupola mixture contained 12½ per cent Vantit pig iron, it was decided to increase this percentage and to eliminate the regular pig iron. Accordingly the following mixture was melted: 300 lb Vantit pig iron, 300 lb steel rails, 400 lb cast scrap. One-third of the silicon was added at the spout as an

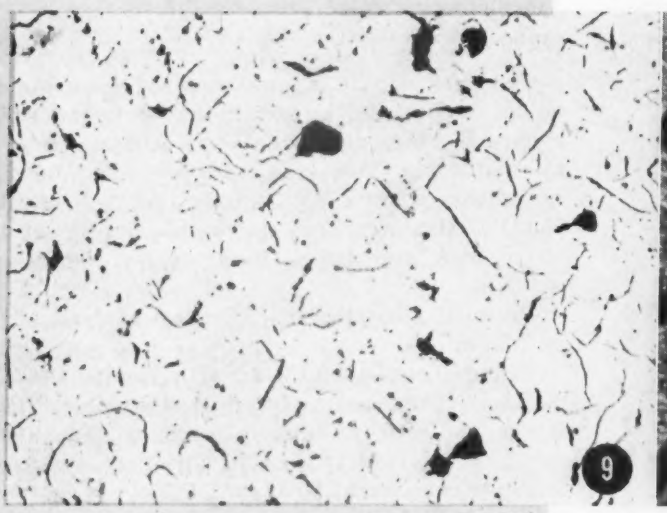


Fig. 9—Series C iron. Unetched, X100. Microstructure resembles nodular iron

Fig. 10—Series C iron. Etched, X1000. Structure is almost entirely pearlitic

inoculant. Vanadium charged was 0.18 per cent and titanium charged was 0.12 per cent.

Physical properties and analysis of Series C follows:

Transverse test—0.373-in. deflection of 18-in. span, 1.176-in. diam, under 3780-lb maximum load. Tensile strength 53,800 psi; brinell hardness (3000 kg) 241; modulus of rupture 100,283 psi; modulus of elasticity 13,451,392 psi. Chemical analysis—TC 3.31 per cent, Mn 0.41 per cent, P 0.14 per cent, S 0.072 per cent, Si 0.94 per cent, Cr 0.10 per cent, Mo 0.59 per cent, V 0.08 per cent, Ti 0.03 per cent. The abnormally low recovery of vanadium was probably due to dilution from both preceding and following charges.

Fig. 9 shows the graphite in Series C iron to be about ASTM Size 5, Type A. However, in this iron some of the graphite flakes are extremely thin, while others have tended towards the nodular form. In fact, the microstructure of this series resembles to some degree the structure of conventional nodular iron of comparable strength. At 1000 diameters the structure is seen to be almost entirely grains of pearlite, with various orientations, and with graphite ranging from very thin to semi-nodular.

Physical properties on Series C tests are excellent; transverse load, tensile strength and modulus of rupture are out of the ordinary, especially with so small an amount of alloy. For illustration, take the SAE highest specification for automotive type cast iron, No. 122. (This is practically identical with ASTM Specification A 159-44T). This specification calls for high-grade cast iron for "diesel engine castings, liners, cylinders, pistons, and heavy parts in general." For comparison:

	Hardness Bhn	Trans. Stgth., lb min.	Defl., in. min.	Tens. Stgth., psi min.
SAE 122	217-269	2800	.30	45000
VT Pig Series C..	241	3780	.373	53800

It will be seen that the iron containing vanadium-titanium pig exceeded by a considerable margin the SAE specification for heaviest duty.

The modulus of rupture, 100,283 psi, is very good. Quoting from the *Cast Metals Handbook*, page 386; "Where cast iron is used as a beam, as in scale parts, or as a ring, as in water or culvert pipe subjected to earth loads, the modulus of rupture should be used in design. The high ratio of modulus of rupture to tensile strength is an important factor in the design of similar parts of cast iron."

The modulus of elasticity was determined by noting the exact deflection at the center of the transverse bar at every 100-lb increase in load, up to the ultimate load. The modulus was calculated at the customary one-fourth of ultimate load, with corresponding deflection at that load.

As the modulus of elasticity is a relative measure of the stiffness, or rigidity of the iron, this figure is of value in design and research.

It is interesting to note that in Series C, where 30 per cent of Vantit pig was used, a residue of 0.03 per cent titanium was found in the castings, coupled with much higher strength. This may indicate that a small amount of the alloy pig (say 10 per cent) is necessary to furnish enough vanadium (0.06 per cent) and titanium (0.04 per cent) to thoroughly deoxidize the melt, and that all the additions of the Vantit pig over 10 per cent may have a cumulative effect. This supposition is fortified by the fact that in Series A castings, where 12½ per cent Vantit pig was melted, there was a striking improvement in graphite structure, but no great increase in strength.

It would be interesting to melt 50 per cent Vantit pig with 50 per cent steel in either electric furnace or cupola. The resulting extremely low sulphur and phosphorus coupled with maybe 0.30 per cent residual vanadium and possibly 0.12 per cent residual titanium should make iron of great possibilities for special applications. It also seems a fair guess that such an iron would have distinctly nodular-formed graphite.

Series D—Working along different lines, experiments were run with an entirely different kind of iron, melted in an electric furnace. The metal was cast in permanent molds. The three main objectives were: 1. Perfect surface. 2. Super-machinability. 3. Resistance to high tempera- (*Please turn to page* 216)

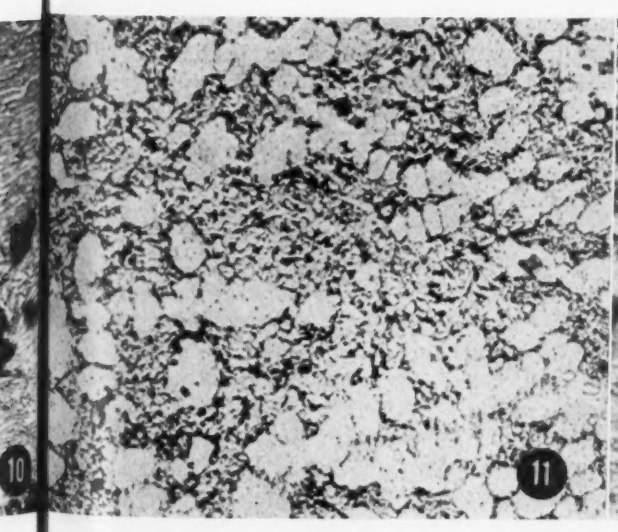


Fig. 11—Series D iron. Unetched, X100. Graphite size 8, longest flakes 1/16 in.

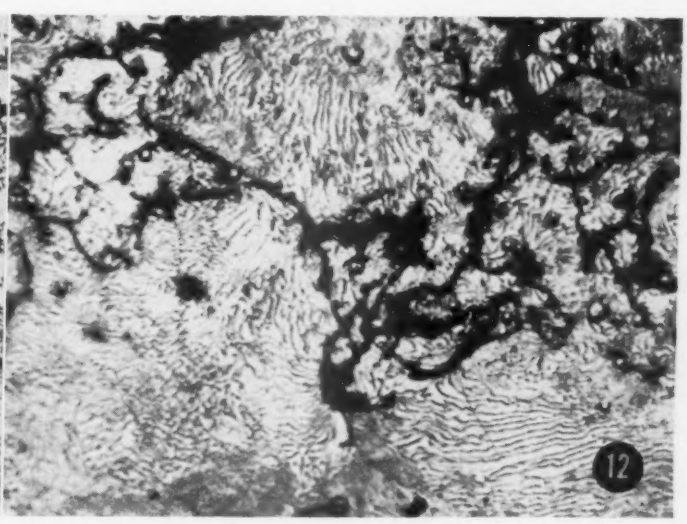


Fig. 12—Series D iron. Etched, X1000. Dendritic "islands" completely pearlitic

Statistical

QUALITY

Quality Control charts in the inspection department at Sharon Works of National Malleable & Steel Castings Co.

THE five plants of National Malleable & Steel Castings Co. operate, so far as practicable, as autonomous units under the direction of their managers. These managers are in turn responsible to the vice president in charge of operations and through him to the president and directors. Certain plant functions, being related to executive policy, have to be centralized. Although the maintenance of quality is a local plant responsibility, the supervision of quality is a duty of the vice president, who exercises that function through two staff departments, inspection and research, each headed by a manager directly responsible to him.

This division of responsibilities arises out of the fact that quality, in a foundry, means both quality of metal and acceptability of castings as to soundness, dimension, surface and the like. The former is a metallurgical matter and as such falls into the scope of the research department which deals with all metallurgical matters, and the latter requires the services of inspection personnel, skilled in gaging, looking for foundry defects, etc.

The purpose of all quality control, statistical or otherwise, is to give assurance that the product leaving the plant meets certain required minima. To be precise, this end can never be perfectly achieved. There is always some risk of substandard product and the statistical approach is actually to reduce this risk to a known and tolerable small probability. It should be appreciated by all, as it was by Army Ordnance during the war, that statistical knowledge of a negligible likelihood of failure to reach a desired minimum quality level is a far better guarantee of satisfactory performance than any amount of individual inspection for the direct measurement of the specified properties, even if that could be accomplished by nondestructive methods. The industries of the country, including this company, owe much to Army Ordnance for their help in introducing quality control methods and their pressure for the use of this approach. It is appreciated that the pioneer work was largely due to Walter Shewhart of the Bell Telephone Laboratories, who generously gave us much help and advice in the prewar period.

First use of control statistics by this company was described by Schwartz in "Examines Foundry Figures Graphically," FOUNDRY, Aug. 15, 1930. In that article the use of statistics (more than 10 years before) to detect falsification of analytical results, was mentioned. We thus have some 30 years of contact with statistical methods for the control of a product.

As in the case of many other scientific approaches to operating problems, the interest in the present subject was confined largely to our scientific personnel until the impact of Army inspection methods. In January, 1944, the inspection department and the research department were instructed to co-operate in setting up a program of statistical quality control for the guidance of the company's executive officers in regard to the quality performance of the several plants.

It is not the purpose here to set out the mathematical principles of statistics or the details of the construction of quality control charts. A number of books have been written on this subject and the American Standards Association has published very adequate bulletins, entitled "Guide for Quality Control and Control Chart Method of Analyzing Data," ASA-Z1.1-1941—Z1.2-1941, dated May, 1941, and "Control Chart Method of Controlling Quality During Production," ASA-Z1.3-1942, dated April, 1942, on the subject. The principle of such charts is to determine the average value of a quality, and from the unavoidable degree of scatter to determine the "control limits," that is, the upper and lower limits which may be expected to contain between them 99.7 per cent of all the observations. The 0.3 per cent of the values outside the limits are considered too few to be worthy of serious attention. For those acquainted with such charts be it here said that we compute the measure of scatter "standard deviation" by the range method, using groups of four consecutive observations.

It has been found profitable to carry quality con-

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trol charts on the composition of malleable iron for carbon, silicon and manganese. Since malleable iron is made by a continuous melting process the master charts are on the basis of daily averages (usually 32 samples at ½-hour intervals). Preliminary study had shown that the scatter of results within a given day was negligible compared with the day-to-day fluctuations. Use of the charts has so far improved the day-to-day uniformity that this may be true no longer and some plants carry daily charts of the half-hourly fluctuations for their own purposes. It is not unlikely that this will become standard practice.

Two kinds of steel, A.A.R. classes "B" and "C" are produced in considerable quantity. On these compositons control charts for carbon and manganese are maintained. Class "C" steel also contains either nickel or vanadium but the adequate control of the final product has not yet necessitated control charts for these elements. Consideration is being given to the desirability of a silicon control chart.

It may seem strange that for neither malleable iron nor steel is a chart for sulphur or phosphorus thought useful. Analyses for these elements are, of course, made but any important changes are always due to "assignable causes of error," that is, to other than chance variations. Hence quality control charts for these elements would not give advance notice of dangerous trends. It is not the policy to keep charts unless either the plant or the research department regards them as practically useful.

The composition charts for steel are derived from an analysis of every heat but the charts are kept for the average composition of four consecutive heats. There is much in the literature indicating that any unusual condition which does not adversely affect the average of four heats is of too transient a character to be traced and corrects itself.

The inspection department makes mechanical tests of four tensile specimens per day for the continuously operating malleable operations. The plants maintain quality control charts from these data. They are independently reported to the manager of inspection and evaluated by the research department as will be discussed presently.

Evaluating the mechanical properties of steel is somewhat more complicated since it serves two purposes. One is assurance of the quality of the outgoing product; the other for the information of the metallurgical staff. The latter needs to know how well controlled its operations are, even though material may, by special heat treatments—retempering, for example—be brought to the required quality, although by lack of control it was originally substandard.

The inspection department breaks a tensile specimen from each heat as soon as the stock and accompanying specimens come from the heat treating furnace. If the results are acceptable the castings are released for finishing and delivery to the customer or his visiting inspector. If the results are unsatisfactory and a reclaiming heat treatment is indicated, a second specimen is broken and this might be repeated in the unusual event that the first reheat treatment does not render the product acceptable.

There are thus two series of mechanical test results, largely, but not quite identical. One represents the results of the accepted standard practice and the other the results characteristic of the material as offered for sale. Quality control charts of the usual form are prepared in the office of the resident inspector at the plant and posted conspicuously in a place accessible to plant personnel and to the representatives of customers.

From the data of the results of standard practice, written records are made and transmitted through the manager of inspection to the research department. Similarly the malleable data are also transmitted. From these data mean values, control limits and mean ranges, including an upper control limit, are computed monthly for yield strength and elongation on steel, and for ultimate strength and elongation on malleable. The results are converted into an expected percentage of rejection (*Please turn to page* 223)

Metallic and Nonmetallic

By CHARLES O. BURGESS
Technical Director
Gray Iron Founders' Society
Cleveland

COATINGS FOR Gray Iron

In this second of three articles the author discusses application of hard facings, diffusion coatings, and electrodeposition of various metals to gray iron castings. The concluding article next month will describe different types of nonmetallic finishes

APPLICATION of hard, wear-resistant coatings to gray iron castings or other base materials by means of either gas welding or arc welding is admittedly one of the most useful expedients available to the designing engineer. These fusion methods, as opposed to spraying are particularly valuable if the castings require heavy, adherent surface armor (⅛-in. or over) resistant to impact or corrosion as well as wear. Gray iron, because of its high carbon content, can be made to possess a very hard outside chilled layer of wear resistant iron carbides simply by very rapid cooling from the liquid state. Thus, hard facing of gray iron is usually resorted to only when: (1) chilling is considered impractical or impossible because of design, (2) a worn part is being built up, or (3) a higher or special order of wear resistance, or corrosion resistance plus wear resistance, is required than can be furnished by a simple chilled layer on the outside surface.

In common with other coating methods, hard surfacing permits the use of a comparatively low cost base material such as gray iron. This is true because only the particular surface that must resist abrasion, impact, corrosion or heat need be hard-faced in most applications. Using hard facing all the economies of longer life of equipment (inherent in the ability of hard-facing alloys to outwear by 2 to 25 times the usual ferrous materials) can be realized. The economies include—in addition to obvious savings in periodic replacement cost of the part—elimination of shut-down time and prevention of a serious loss in operating efficiency of the part previous to final replacement.

Some of the gray iron castings satisfactorily hard faced by oxyacetylene and arc processes include crushing rolls, large blades used to mix sand and cement,

pulverizer disks, muller tires, augers, pug mill knives, pump castings, conveyor screws and agricultural machinery. Accompanying illustrations show some of these typical uses of hard-facing materials in the casting field.

Hard-facing alloys are furnished in rod or tube form to facilitate their deposition by either gas or arc welding. They are normally divided into four classes:

Class I—Ferrous base alloys with less that 20 per cent of alloying elements such as chromium, tungsten, manganese, silicon, carbon, and nickel. Included in this class are steels in which wear resistance is sacrificed to toughness. Some alloy cast irons are also included.

Class II—Alloys with over 20 per cent of alloying elements of the type contained in Class I, generally less tough but harder than the Class I alloys. High-carbon, high-chromium alloys, often with smaller amounts of manganese, molybdenum, etc., are among the most common rods in Class II.

Class III—Nonferrous alloys whose main constituents are typically chromium, cobalt and tungsten, although special elements such as boron may be present, and nickel may be used instead of or in addition to cobalt as a matrix in which to hold carbides or compounds of the other alloying elements. In this class are the so-called Stellite type alloys, valuable for corrosion resistance and wear resistance at high temperatures.

Class IV—The so-called diamond substitutes that consist usually of tungsten carbide, although tantalum carbides, titanium carbides or borides of chromium are sometimes present. The extremely hard materials in this last class offer maximum wear resistance, and are normally furnished as (1) cast inserts ready to be welded in place, (2) as a composite rod in which the particles of tungsten carbide are embedded in a fusible alloy such as steel, or (3) as tungsten carbide particles or powder enclosed in a steel tube (60 per cent tungsten carbide, 40 per cent steel). In the latter case, the melted steel acts to bond the carbide particles to the wearing surface during the welding operation. The carbide particles, unless very fine, resist any melting action.

All the foregoing hard-facing materials can be applied to gray iron, although by far greatest use has been made of Class I and II hard-facing alloys. Of these the high carbon (2 per cent or above), high chromium (15-30 per cent) alloys have proved most advantageous. Effective use of these less costly grades of alloys is possible because dilution of the deposited metal with gray iron is generally not as deleterious as with lower carbon alloys. The higher carbon contributed by the gray iron base is, in fact, often beneficial in maintaining wear resistance. High manganese and stainless steels have also been found useful in applications where resistance to impact and corrosion is needed.[35]

Although both gas and arc deposition have been widely used commercially, it is not always understood that the technique of applying any hard-facing alloy to gray iron should differ drastically from that employed in the case of mild steel. In fact, the technique closely approaches that required for very high carbon steels, and failure to realize this fact has led to much unjustified prejudice against gray iron as a base for depositing hard-facing alloys by fusion.

It is initially assumed that the casting has been thoroughly cleaned to remove both surface and impregnated oil, dust, rust, etc. This precaution applies in the case of any metal to be hard faced. Cleaning is particularly desirable in rebuilding or resurfacing castings contaminated from being in service. It is also generally recommended that the depth of hard-facing coatings be limited to ¼-in. If a greater build-up of the surface is necessary, it should be done using undercoats of a low carbon steel rod, a nickel rod, or a rod similar in composition to the base metal.

Although arc welding is usually the most rapid and cheapest deposition method[36], there is no question

Fig. 7—Hard-faced muller tires. As much as 300 lb of material may be deposited on wearing faces of a pair of such wheels, which are 12 ft in diam

Fig. 8—Hard-faced augers 18 to 24 in. in diam

Fig. 9—Gray iron pump casting. The 36-in. inside diameter is lined with hard-facing material

Fig. 10—Comparative wear of uncoated and hard-faced pug knives. Coated piece is shown at left

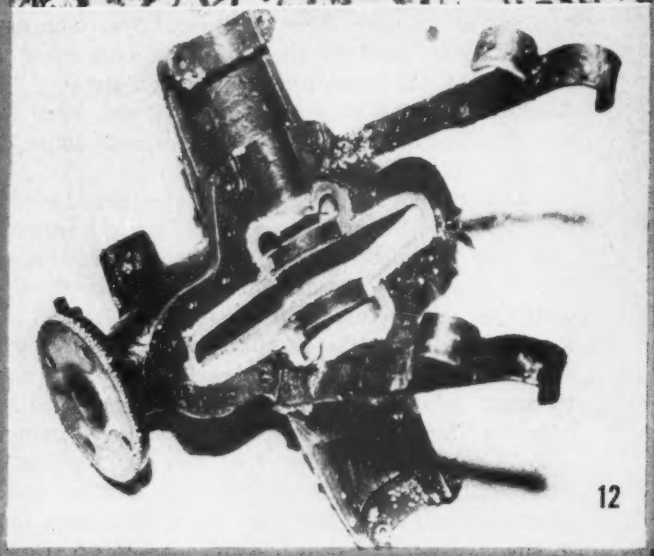

Fig. 11—Photomicrograph showing case on gray iron chromized for three hours at 1035° C

Fig. 12—All surfaces of this beer pump in contact with liquid have a heavy nickel plate

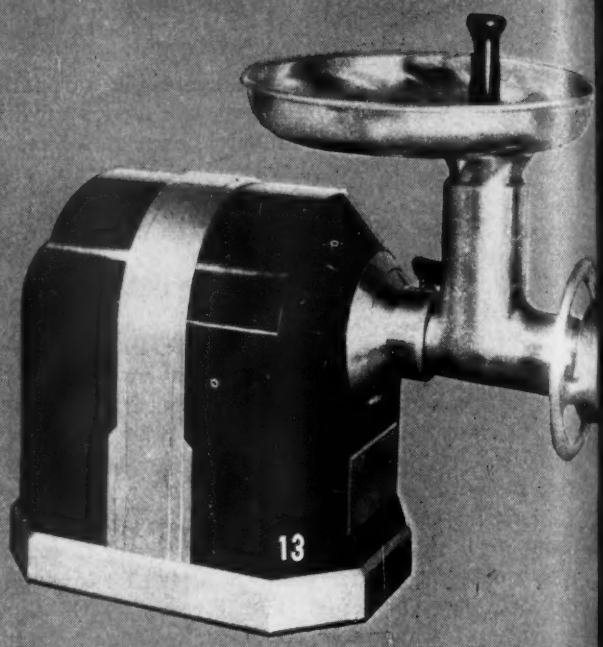

Fig. 13—Meat chopper with chromium-plated parts. Chromium has progressively become more important as a gray iron surface finish

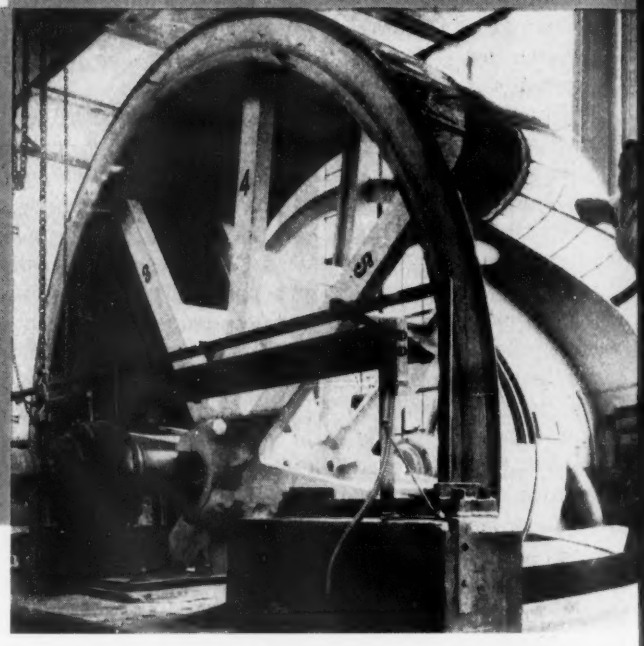

Fig. 14—Nickel-plated iron film casting wheel

that the base metal is exposed to steeper thermal gradients and more decided thermal shock in the arc process than in gas welding, and several expedients have been commonly employed to lessen danger of cracking the base metal, particularly if adequate preheating is not available. These include: (1) using a low current density to minimize both heat penetration into and melting of the base metal; (2) after initial deposition of the first hard-facing material, deposition of further hard-facing material by directing the arc against the preceding bead of hard-facing material rather than against the base metal; (3) welding down-hill to minimize the zone of penetration, and (4) skip welding, back welding and weaving.

Gas welding, as a means of depositing the hard-facing alloys, possesses the advantage that the oxy-acetylene flame itself can be used to preheat the area to be hard faced and to avoid sharp temperature gradients. This is particularly advantageous when small castings such as dogs, certain types of gear teeth, etc., must be coated. In the case of larger castings standard preheating precautions should normally be observed. A much smoother final surface is produced in gas welding than is usually possible using arc welding. It is also possible to readily apply much thinner coatings using the gas method.

The lower melting point bronze alloys have proved to have definite value in building up worn surfaces and furnishing localized corrosion resistance, and have, therefore, been widely employed. Because of their low melting point, little or no difficulty is en-

Fig. 15—Electrotinning gray iron piston rings

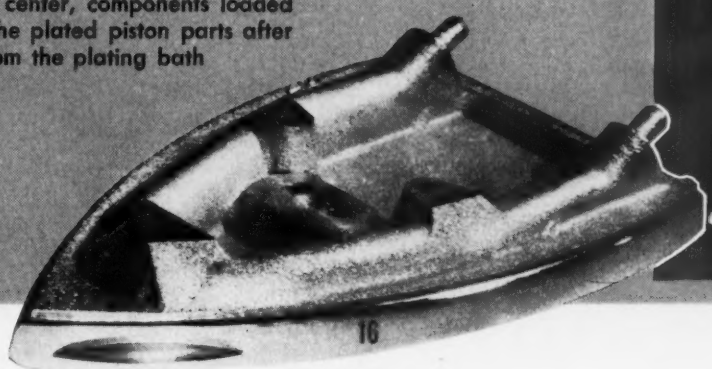

Fig. 16—Gray iron sole plate for this electric iron is protected by chromium plating

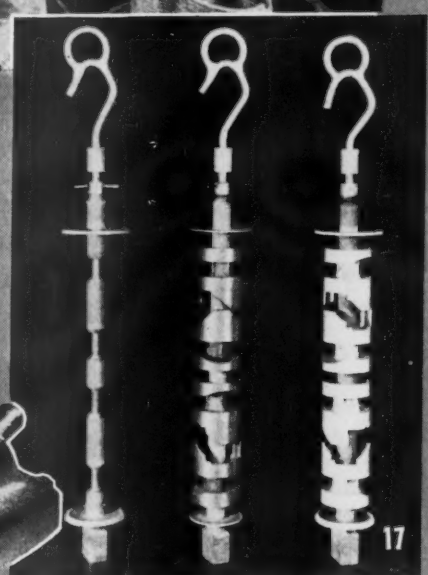

Fig. 17—Right, typical rack for plating gray iron piston components; center, components loaded for plating; right, the plated piston parts after removal from the plating bath

countered in their application. They can, however, hardly be classed as true hard-facing alloys.

Cementation or Diffusion Coatings—In cementation processes, as in hot-dipping, an alloying action takes place between the surface layer of a desired metal and the underlying gray iron. Cementation differs, however, from hot-dipping in at least two important particulars. First, the use of a molten metal is not required, the casting instead being heated in (1) a powdered metal, (2) a gaseous atmosphere of volatilized metal or its salts, or (3) a fused bath of metal salts. Second, since the cementation reaction is "really a slow creeping of one metal into another,"[37] the final coating is comparable to the inner or alloy layer of a hot-dipped coating of the same metal.

Aluminum (Calorizing) — The calorizing process consists essentially in heating an article in contact with aluminum powder, alumina, and ammonium chloride for the purpose of diffusing aluminum into the surface of the base metal and thereby increasing its resistance to oxidation at high temperatures. It has been successfully applied to gray irons[38] as well as other metals. Equal protection, however, is not afforded all metals. It is pointed out by investigators that at very high temperatures the tendency for some gray irons to "grow" on repeated heating and cooling will tend to crack-up or "craze" the surface oxide or aluminum-containing skin produced on the casting by calorizing. This is followed by oxidation along the lines where the skin has fractured. It is, therefore, (*Please turn to page* 225)

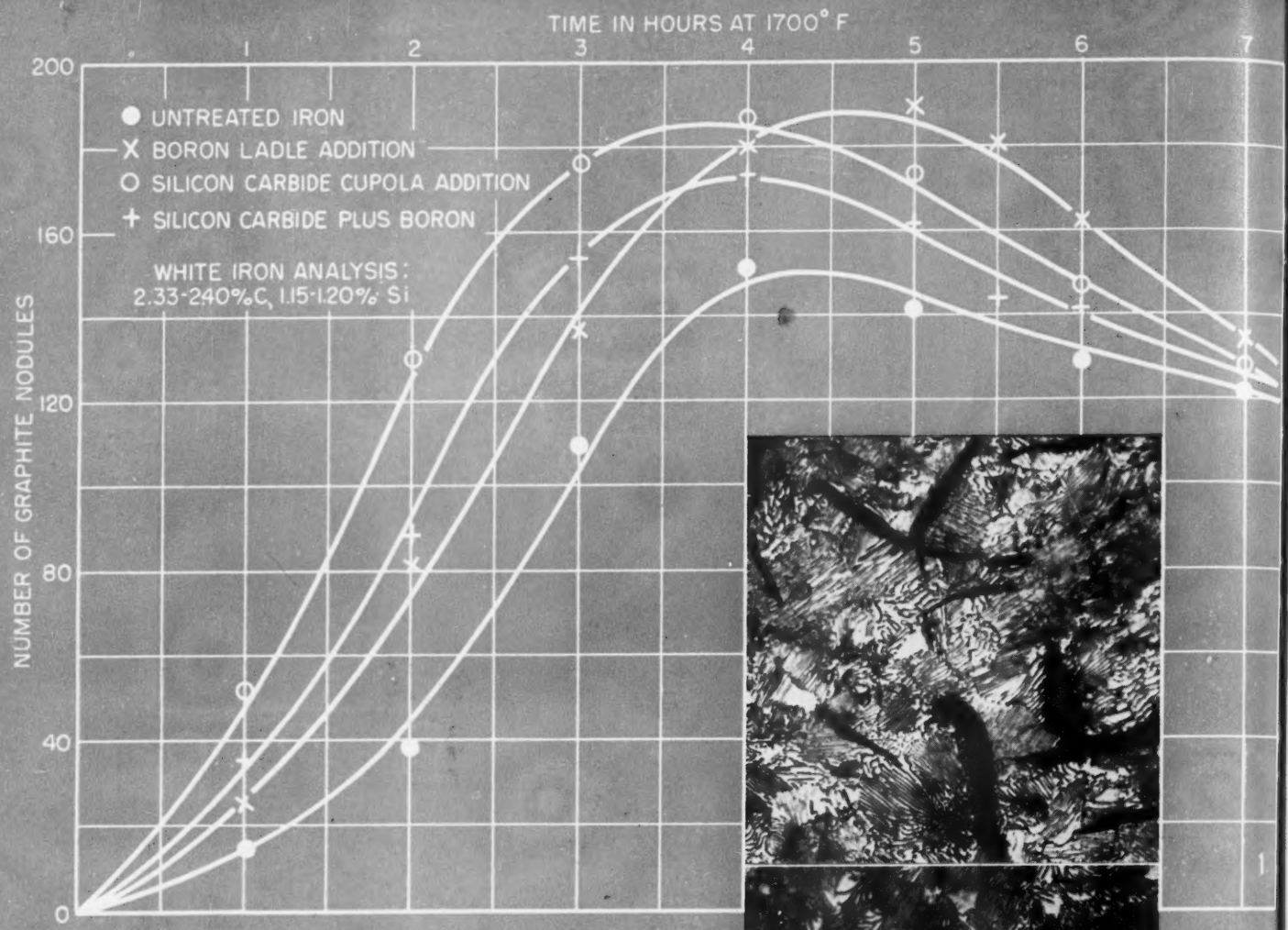

Fig. 1—Number of graphite nodules observed at X100 within a 6½-in.-diam field in white iron malleabilized at 1700°F for times indicated. Each point is the average of five values

Fig. 2—Microstructures in irons of comparable analysis. Top, showing randomly distributed graphite in metal deoxidized with silicon carbide. Bottom, interdendritic graphite and ferrite structure in metal not deoxidized. X500, picral etch.

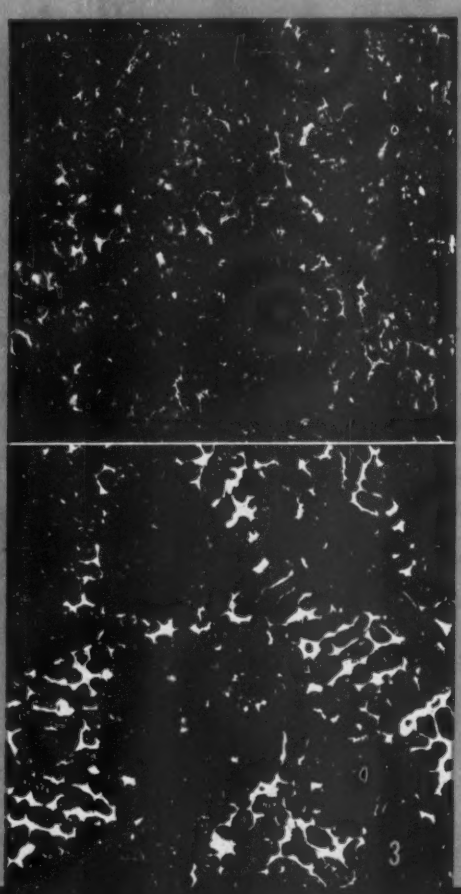

Fig. 3—Representative microstructures at center of ⅜-in. section. Top, deoxidized metal, carbon equivalent 4.13 per cent, phosphorus 0.74 per cent. Bottom, metal not deoxidized, carbon equivalent 4.20 per cent, phosphorus 0.70 per cent. X100, picral etch

Causes of excessive amounts of iron oxide in gray iron and malleable iron castings and their influence on microstructure and other properties are described. The discussion also covers deoxidation methods, with particular reference to silicon carbide additions to the cupola

EFFECT OF *Oxygen Content* ON IRON CASTING PROPERTIES

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IT HAS long been recognized by iron foundrymen that unexplained variations occur periodically in the metal which adversely affect the properties and soundness of their castings. These variations have led to epidemics of casting defects such as hard castings, porosity, internal shrinkage, misruns and cold shuts, cracks and hot tears, and poor physical properties. When in the midst of such troubles, the foundryman quickly, and sometimes frantically, makes whatever changes he can logically conceive in his melting or foundry practice in order to get out of his difficulty.

Due to the general lack of knowledge as to the cause of such epidemics, and the urgency involved, very little controlled experimentation has been conducted during these periods of difficulty and the trouble usually disappears, leaving the foundryman with no idea as to what change it was he made, if any, which eliminated the source of his trouble.

This lack of knowledge has, of course, led many things to be blamed for these casting difficulties. The greatest weight of evidence, however, has indicated that the trouble originates in the pig iron, and the intangible term "heredity" has been used to define the property which makes the iron so variable. This term became useful because it was early learned that individual lots of pig iron known to produce good and bad castings, respectively, appeared to be identical as far as could be determined by the usual methods of chemical analysis.

In the early 1900's Dr. Richard Moldenke, an eminent authority on foundry practice of that time, recognized the variable nature of pig iron and the difficulties this caused to foundrymen. His work enabled him to relate "off-grade" pig iron to the appearance of the fracture of the sand cast pigs. The off iron showed a white or partially white fracture, while that of "good" pig iron was entirely a dark gray color. The introduction of pig casting machines, however, altered the appearance of the pig iron fracture to the point where this test was no longer reliable.

Over 20 years ago the Eastern States Blast Furnace and Coke Oven Association took cognizance of the fact that pig iron had some variable quality which was not understood, and at a 1927 meeting in Pittsburgh one of the major topics under discussion was, "What is there in pig iron, not shown by the regular analyses, which causes the foundrymen to have trouble with their castings?"

Gillett[1], in his American Foundrymen's Society lecture on "Cupola Raw Materials" in 1944, also touched upon this subject when he stated, "Cupola products do show considerable nonuniformity, some of which results from known and understandable causes affecting composition as to elements normally analyzed for, but some of which arises from causes less well understood and not yet subject to adequate control. . . . Uniformity of the cupola product properly would require more uniformity in raw materials than is the case with many other foundry products. However, most cupolas do struggle along against distressingly nonuniform raw materials, and the effects of variations in raw materials do tend to carry through to the finished product — the product showed 'heredity.'" Similarly, in a paper on malleable iron melting, Morrison[2] stated that "heredity of pig iron, as far back as the ores from which it is made, can be carried into the iron in the finished state even when the pig iron is used in the charge in small quantities."

The first comprehensive study relating casting defects to variations in the pig iron, to come to the author's attention since Moldenke's early work, was made by Hurst[3] in 1944. In this instance, a British foundry producing continuously a particular casting by uniform mechanized methods, involving modern methods of sand preparation and metal melting control, experienced at irregular intervals over a number of years, epidemics of porosity which were revealed on submitting the castings to hydraulic test.

In studying this condition, Hurst found that the pig iron used also varied. Sometimes it was easier to break and showed a more open grain structure than at other times. The occurrence of this open-grained pig iron also appeared to be associated with the occurrence of porosity epidemics. Chemical and physical tests on good and bad lots of castings and pig iron indicated that all were similar, but microscopic studies revealed a difference between the good and bad lots. Good pig and good castings had a random graphite structure while that of the bad lots of pig and castings was dendritic. Thick section of the bad metal, whether in pig iron or in the castings, produced from the poor pig iron, showed unusually coarse graphite. By conducting vacuum fusion tests to determine the quantities of dissolved oxygen, hydrogen and nitrogen, Hurst found that the poor lots of pig iron and the porous castings produced from such pig iron both contained unusually high quantities of dissolved gases, particularly hydrogen and oxygen.

Moldenke was convinced that the dissolved oxygen probably occurring as ferrous oxide, in the pig iron was the source of difficulty which later caused defective castings to be produced in the iron foundry. He also concluded that even with good pig iron in the cupola charge, the danger of similar oxidation occurring during cupola melting is ever present, because, here too, oxygen in the air blast is continuously brought into contact with hot molten metal with resultant oxidation of the metal and metalloids.

It has only been in comparatively recent years that sufficiently accurate methods and techniques have been developed for measuring gas contents of iron to evaluate Moldenke's theories, and the evidence now available, based on tests made within the last ten years, serves to substantiate his claims.

The fact that such evidence has been forthcoming has served to reopen the subject of oxidation of iron and many have come to realize the benefits to be derived from deoxidation treatments.

Zapffe and Sims[4] laid the groundwork in 1942 when they reported that oxygen may be dissolved in molten irons as SiO, and that in this form there may be relatively large amounts of oxygen present in the iron. Work by Schneble and Chipman[5] led them to conclude that oxygen may be dissolved in cast iron as CO. Results of vacuum fusion tests by Hurst,[3] and Hurst and Riley,[6] showed the presence of as much as 0.080 to 0.120 per cent oxygen, even in irons with a high silicon content. Heine[7] points out that thermodynamic calculations involving the Oxygen-SiO system show that as much as 0.124 per cent O may be present in the 0.90 per cent Si iron at 2910°F as compared to the 0.004 per cent O calculated in the Oxygen-SiO_2 system. Results of indirect wet chemical analysis methods reported by Schwartz[8] show values of 0.004 to 0.019 per cent oxygen in white irons for malleable castings.

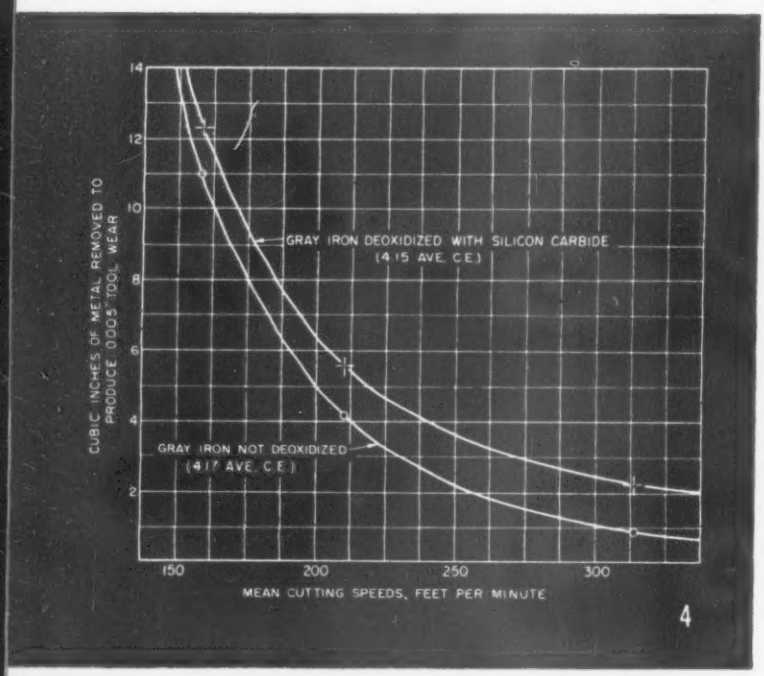


Fig. 4—Machinability test results on deoxidized gray iron and on iron not deoxidized

TABLE 1—Reduction in FeO Content of Cupola Slags by Silicon Carbide Deoxidation

	Ave. % FeO	No. of Samples	% Reduction in FeO
Plant No. 1:			
Slags from undeoxidized heats	3.23	12	
Slags from deoxidized heats...	2.59	12	19.8
Plant No. 2:			
Slags from undeoxidized heats	9.32	12	
Slags from deoxidized heats...	6.35	12	31.9
Plant No. 3:			
Slags from undeoxidized heats	1.47	20	
Slags from deoxidized heats...	1.00	16	32.0

Causes Ill Effects

Having established the fact that high oxygen contents do exist in iron as the result of oxidation, either in the blast furnace or in the cupola, we might now logically ask—what are the ill effects associated with the occurrence of oxidized iron? Forty years ago, Moldenke[8] had this to say—"Long experience in the foundry business has taught the writer that whatever cause may be put forward for such defects in castings as pinholes, excessive shrinkage, draws, and cracks, and for others due to metal and not to the molding; practically all of them can be traced back to burned iron. . . . . A little oxygen can do an immense amount of damage. The very worst burned iron ever seen by the writer contained only a few hundredths of 1 per cent. The evils of sulphur are as nothing compared to it". He sums up the ill effects of oxidation of iron as follows:

1. Raises freezing point causing metal to have less fluidity or "life."

2 Increases internal shrinkage.

3. Increases the amount of combined carbon making castings harder and more difficult to machine.

4. Increases cracks and hot tears due to higher shrinkage of iron.

5. Increases chill.

6. Causes gas holes and sub-surface porosity due to carbon-oxygen reaction.

7. Increases segregation because of the lower melting point of the contained oxides.

Later investigators have been adding experimental data substantiating more and more of Moldenke's claims.

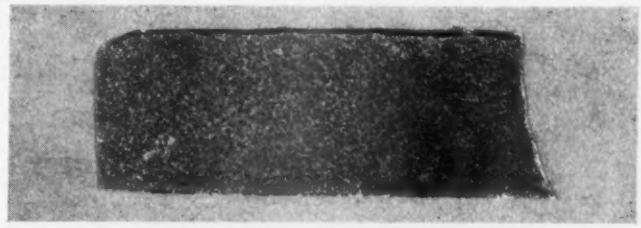
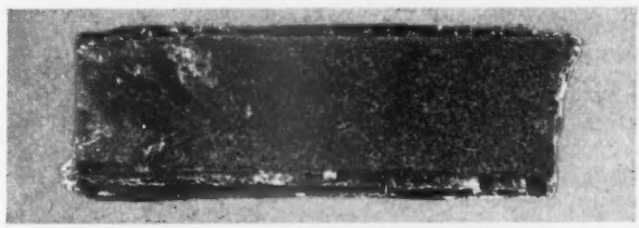
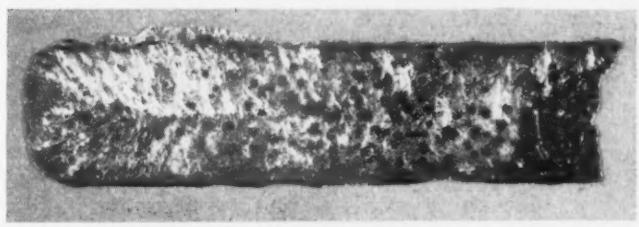
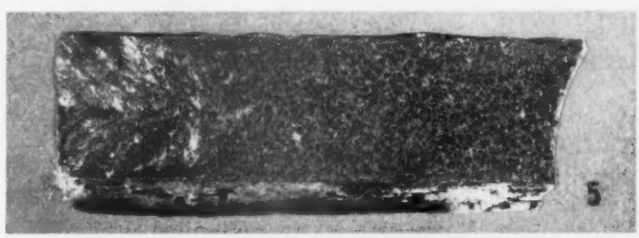
Sample	C.E.	Sand Type	
Deoxidized Gray Iron			
12-20	3.83%	Green	
12-22 Avg.	3.77 3.75%	Dry	
Untreated Gray Iron			
12-14	3.91%	Green	
12-16 Avg.	3.72 3.81%	Dry	

Fig. 5—Macrostructure of ¼-in. cross sections of deoxidized and untreated iron. X4, picral etch

Sources of Oxidation—Variations in blast furnace operation which produce a variable degree of oxidation in pig iron occur even under the best conditions of modern blast furnace practice, and oxygen, presumably as oxides, consequently occurs in the iron. It must also be remembered that even with the best pig iron, the danger of oxidation is also ever present during cupola melting, as emphasized in Moldenke's work. The author has determined from experimental work in a number of foundries that other metallic ingredients in the cupola charge, in addition to pig iron, may serve to introduce excessive amounts of oxygen into the melt. Such materials may consist of porous or rusty scrap, oxidized ferroalloys or even materials such as coke, which may introduce excessive moisture into the cupola.

Since cupola melting entails the oxidation of substantial quantities of carbon, silicon and manganese, the danger and probability of experiencing excessive oxidation of the iron is consequently much greater than in the blast furnace.

The white-hot iron in the melting zone of the cupola is continuously subjected to the impingement of oxygen contained in the air blast and also formed by decomposition of moisture in the blast. At the high temperatures prevailing, reaction occurs readily between the iron and oxygen to form ferrous oxide. Much of this oxide can go into solution in the molten iron.

Use of Deoxidizers—Since the sources of iron cannot be placed under satisfactory control, the solution to oxidation problems must be sought through the use of sufficiently strong deoxidizers which may be added to the melt. Moldenke found that the addition of closely controlled quantities of aluminum or titanium to iron was effective in reducing or entirely eliminating casting defects resulting from oxidized iron.

Lorig and Samuels[10] (*Please turn to page* 237)

QUESTIONS and

Core Oven Facilities Lacking

Q.—Can you give us information on a good dry binder to be used in a core for a bronze bearing? Core is 4 in. diam and 11½ in. long, made in a split box without rods, and rolled out on a flat plate. Metal thickness of bearing is ¾-in. We are using a 50-50 mixture of building and black burnt sand which is put through a No. 8 riddle. We want a quick drying core as our main trouble is lack of core oven space for drying same.

A.—Although you do not mention the type of binder you now are using, we assume that it is a dry material, and you are interested in securing one which will dry or bake more rapidly. As you undoubtedly know, all core mixes require a certain amount of water to act as vehicles or carriers to distribute the bonding material uniformly throughout the mass as well as to make it workable. The water must be driven off in the baking process, and in general the time required for that phase occupies the greatest part of the cycle. Hence, difference in baking times between different dry-type binders usually is not dissimilar.

Roughly, your core has a volume of 144 cu in. and weighs about 9 lb. Since it is chunky more time will be required for baking than if it had a thin section. You mention that you roll the cores out on a plate, and we wonder if you have tried standing them on end so that you could place more on a plate, and thus be able to bake more cores in a given area. For example, on a 12 x 12-in. plate you can place only two cores in the horizontal position while four can be set vertically.

Water in Sand Causes Holes

Q.—We are forwarding for your inspection a piece of stoveplate casting showing a lot of small holes on the face or drag side. Metal was poured through a number of small thin gates at one side. This surface condition is intermittent. At times the castings are free of this defect, and then it may be present for a few days. It is not confined to the casting submitted for examination, but may appear in any casting, particularly the larger ones. We shall appreciate an opinion on the cause of this particular defect.

A.—The small and, in some cases, almost microscopic pinholes scattered over the face of the casting are produced by small steam or gas jets and these in turn may be traced to water or small clay balls in the sand. The defect definitely is a sand condition and not related in any manner to the gating, or to the composition or temperature of the iron. Experience seems to indicate that the sand is just on the moisture content border line. Hence the intermittent appearance of the defect. When the moisture content is above the border line the defect appears. When it is below the border line there are no microscopic jets or explosions.

The obvious remedy is to determine this border line and then maintain the sand rigidly at or below the line of moisture content. This border line or, perhaps more properly speaking, the maximum and minimum moisture content will vary to some extent with any given sand. Grain size and amount of bond are closely related factors that must be taken into consideration. You do not state whether or not your foundry is equipped with sand control and testing devices. With this equipment you readily can determine the proper moisture content for your sand. Of course, it is part of the shop discipline to see that instructions from the sand laboratory are adhered to closely.

It may be pertinent to point out that it is difficult if not impossible to maintain close control in a shop where every molder tempers his own sand heap. While it is true that highly skilled molders, past and present, have been and are competent to prepare the sand, it is also true that they no longer form a majority. Also no secret is exposed by the statement that the average molder prefers sand on the wet side, because it is more workable and reliable.

Make Pressure-tight Castings

Q.—Have you available for distribution or can you advise us regarding sources of technical information regarding the casting of pressure type castings or use of impregnating compounds and technique for making castings pressure tight?

A.—Production of pressure tight castings is the result of close co-operation of designer, foundryman and metallurgist since it is only through their joint efforts that castings possessing the required mechanical properties for the service intended, lowest weight, and desired appearance are made at the lowest possible cost. Fundamentally, in producing a sound, dense casting, whether it is to be pressure-tight, or otherwise, it must follow the principle of directional or progressive solidification. That is, it must begin to freeze at those points farthest from the gate, and that action gradually and uniformly proceeds until it reaches the gate which is last to freeze.

Avoidance of abrupt changes in section, eliminating sharp external and internal corners, use of flat, wide ribs in preference to deep narrow ribs, coring bosses, location of heavy sections so that they may be fed properly, etc., are features which aid in mak-

nswers

ing sound, dense castings. Study of *Fundamentals in Production and Design of Castings* by Marek will be worth your while.

As far as use of impregnation to seal slightly porous areas of castings is concerned, two procedures are employed. One method is to immerse the castings in the sealing agent, usually a synthetic resin or plastic, allow it to drain, and then bake to polymerize, condense or harden the material. The other involves the use of an autoclave in which the castings are placed and subjected to a vacuum. Then the sealing agent is admitted in the evacuated chamber, and the whole subjected to pressure. Pressure is released, sealing agent removed, castings allowed to drain, and the latter are baked. Further details may be secured from firms supplying sealants and equipment whose names are listed in the Where-to-Buy Directory on page 254.

Using Steel Scrap in Mixture

Q.—We operate a gray iron foundry in India producing castings for machine tools, agricultural implements, building fitting equipment, etc., and would like to obtain information on the following: We would like to know how much steel scrap can be used with pig iron in the making of plow shares to obtain castings with long life. We also would like to know a good green sand molding mixture. What flux is used to get clean castings? What percentage of pig iron should be used with hard cast-iron scrap?

A.—Since many details on your metal compositions or mixtures, and your present practices are not given in your inquiry, we cannot supply any definite answers. With reference to use of steel scrap in the charges for making plow shares, it mainly consists of adjusting the silicon content of the resultant iron so that a suitable structure is obtained. As you undoubtedly know, use of steel scrap with its low carbon content lowers the total carbon content of the iron emerging from the cupola, and produces a finer type of graphite as well as metal structure. However, the steel scrap also is quite low in silicon, and to prevent occurrence of white fracture or hard iron, it is necessary to add that element through use of high-silicon-content pig iron, ferrosilicon, or other silicon-containing graphitizing agents.

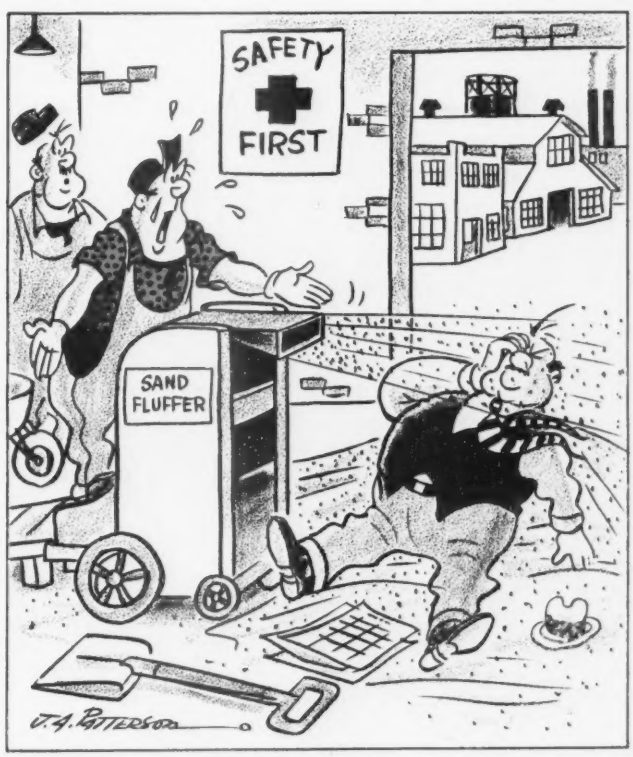
For example, suppose you were using a mixture of 400 lb pig iron containing 1.50 per cent Si, and 600 lb cast iron scrap containing 1.00 per cent Si to obtain a resultant iron containing slightly over 1.0 per cent Si, and decided to substitute steel scrap for 50 per cent of the pig iron. The charge then would be composed of 200 lb of pig, 200 lb steel scrap, and 600 lb iron scrap. Calculation will show that with the 1.50 per cent Si pig, the resultant iron would lack 2.5 lb of silicon per charge (1000 lb). Hence, you would have to substitute 200 lb of 2.75 per cent Si pig for that containing 1.50 per cent Si, or use 3 lb 2 oz of 80 per cent ferrosilicon in the charge. Since the amount of ferrosilicon to be added is small it could be added in the ladles, and a better recovery obtained as well as an inoculating effect on the iron. A ladle addition of 4 oz to 100 lb of iron probably would serve. Likewise, a similar amount of a silicon-bearing graphitizing agent might give the desired result. However, the only way to determine the best procedure and amounts of materials to be used would be to do some experimenting.

As to a suitable green sand molding mixture, we can only say that it should be as fine as possible to produce the desired surface finish without causing difficulty from blows due to lack of permeability. It should contain sufficient bond to make it workable as well as to resist cutting, washing or erosion of the molten metal. Without equipment to determine such data as grain or screen size and distribution, green compression strength, permeability, moisture content, etc., you will have to try out batches of the various sands available. Or, take some of your present sand and open it up with additions of coarse sand or close it by adding finer sand as the case may be.

By flux we assume you have reference to melting in the cupola, and the material in general use is limestone. The amount used is 3 per cent of the weight of the metal charge or 60 lb per 2000 lb, although it may be more or less depending on the cleanliness of the pig and scrap, and amount of ash in the coke. With reference to the amount of pig

GANGWAY!

By J. A. PATTERSON



"Honest, Boss—I didn't know it was loaded!"

QUESTIONS *and Answers*

iron to be used with hard iron scrap, the method is similar to that outlined for using steel scrap. For a quick approximation with only two components (pig and scrap) in the mixture, and on the basis of 1000-lb charge, you could employ the following formula:

$$\frac{1000a}{y} = wc + (1000 - w)b$$

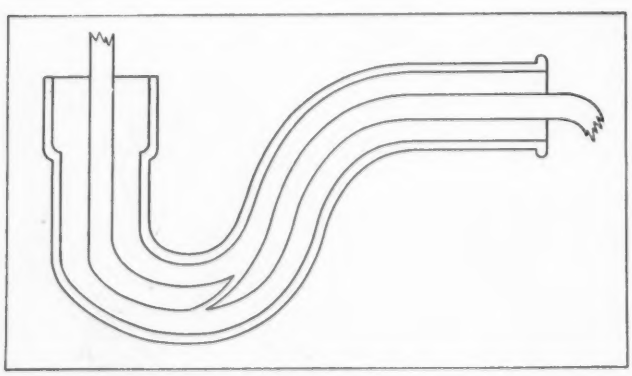
where $y, a, b,$ and c are the decimal values of percentages; and y is that for the difference between 100 and the loss of Si in the cupola, a the Si desired in the resultant iron, b the Si in the pig, c the Si in the scrap and w is weight in lb. Also $1000b$ must be greater than $1000a/y$ and wc. For example, assuming that the Si loss in the cupola is 20 per cent, the Si content desired in the iron to be 2.40 per cent, the Si content of the pig iron to be 3.10 per cent, and the Si content of the scrap to be 1.50 per cent, the formula shows that 62 lb of scrap can be used with 928 lb of the pig iron.

Need Continuous Vent in Core

Q.—With the exception of one item we have no trouble with our soil pipe fittings. This exception is the *P*-trap casting shown in the accompanying free-hand sketch. A gas pocket develops on the top side of the curved section. We shall appreciate information on how to prevent this form of defect.

A.—Briefly, the way to prevent the formation of the gas pocket on the top side of the curved section in the *P*-trap casting, is to run a generous size continuous vent through the center of the green sand core. At present in all probability a vent rod is laid or pushed in as far as possible through each of the open ends. Neither of the rods goes through the curved section of the core. Without a free passage from this section, the generated steam rises to the top and forms the pocket on top of the casting.

Method of venting the entire core depends on whether the core is rammed as a unit inside the shell pattern, or is rammed in two separate half core-boxes, then booked, lifted out and placed in the mold. In the first instance core and mold are made at the same time. The core is not removed and then returned to the mold. Core and cope half of the mold are rammed first and rolled over. The drag is rammed and lifted off. The drag half of the pattern is removed. The drag is replaced and the assembly is rolled over. The cope and cope half of the pattern are removed. The cope is then replaced. The core is not disturbed at any time. It remains firmly resting in the prints and on the arbor extensions.



Two short pieces of rope or heavy sash cord are pulled out through the ends before the pattern is taken apart

To form the vent in this type core, lengths of ½-in. rope are incorporated along the center line of the core and project through the prints at each end as shown in the sketch. The ropes are pulled out before the pattern is taken apart. The process is simpler where the core is made in halves and booked. Before the two halves are brought together, a vent channel is formed along the center line either with a gate cutter or with a vent plate. One method is about as fast as the other, but the vent plate does a more workmanlike job. The flat vent plate is fitted with dowels or dowel pins that fit over corresponding members in the corebox and thus guide the half round vent projection accurately into place along the center line of the half core face. The plate usually is formed from thin sheet steel. The vent forming member is a piece of half-round rod welded in place.

Change in Coke Causes Trouble

Q.—Due to our inability to obtain 3½ x 5-in. size coke for our 36-in. cupola, we have to use 2½ x 3½-in. size, and are running into trouble with a sticky slag which reduces flow of iron from the taphole. Previous to using the smaller size coke we did not have any trouble. We did not make any changes in bed height or air supply from a fan-type blower. We used to tap 1000 lb iron in 8 to 10 minutes, but now it takes 10 to 14 minutes. Trouble begins before iron shows at the taphole as a sticky slag tends to freeze in it, and at the first and second taps, the hole can be opened only enough to permit a stream of about one-fourth the volume it should be. Subsequent taps increase in volume, but cupola well cannot be emptied quickly enough to allow pouring before another charge is ready to be tapped. From this incomplete information can you suggest possible cause? We do not have an analysis of the coke, but think that the trouble is not in quality of the coke.

A.—Your difficulty with cupola operation is a good example of the cause showing only an effect which is not readily associated with it. The slag unquestionably is reducing the size of the taphole and consequently decreasing the flow of iron. The sticky slag is freezing in the taphole because both are cold. This condition points toward the real cause—cold iron due to insufficient air. A fan-type blower delivers air in direct relationship to the resistance on the discharge side; that is, low back pressure will permit a high volume of delivery and a high back pressure will reduce the delivery. In this instance the small coke has increased the back pressure with consequent reduction in air volume. As a result, the combustion

(*Concluded on page* 108)

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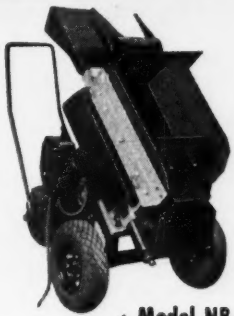
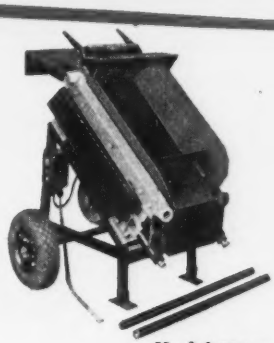
The Junior Royer
4 to 7 tons
per hour

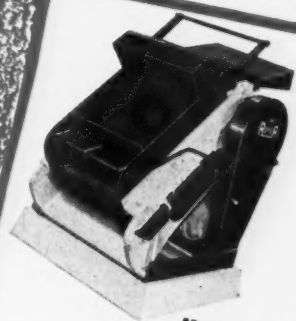


Model NB-4
7 to 9-½ tons
per hour

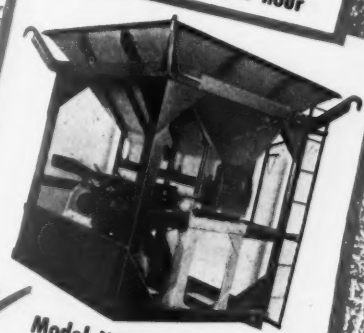


Model NC-2
12 to 15 tons
per hour

Model NDP
20 to 25 tons
per hour



Model NRS
40 to 50 tons
per hour



Model NDC Combination
20 to 25 tons per hour

Economical sand preparation is the first major step in reducing overall casting costs. One man with a Royer Sand Separator & Blender can condition enough sand in a few minutes to supply an entire molding crew for several hours. All he need do is shovel the sand into a low hopper and the Royer does the rest . . . automatically and efficiently. When properly employed, Royer Sand Separators and Blenders will lower sand conditioning costs as much as 50% over slow, wasteful, man-hour consuming hand blending and riddling.

And the evenly blended and moistened, completely aerated, refuse-free molding sand helps secure economies in many other ways. New sand requirements are lowered . . . the higher grade, smoother surfaced castings produced require much less machining or grinding time . . . and rejects due to runouts, scabs, skids and other defects are greatly reduced.

More than 8000 Royers are in use in foundries today —large and small—jobbing and production—ferrous and non-ferrous. Over one half are repeat orders . . . a worthy testimonial to the value of these cost cutting machines. *Check the Royer you need.* Then send for bulletin giving complete information on electric motor, gasoline engine or belt-to-tractor driven portable or stationary models in capacities from 4 to 50 tons per hour.

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FOREMOST IN SAND CONDITIONING EQUIPMENT

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159 PRINGLE ST., KINGSTON, PA.

QUESTIONS *and Answers*

(*Concluded from page* 106)

temperature has been decreased and the slag is very cold. Slowing of the melting time and the sticky slag reflect that condition.

Correction of the trouble can be effected by: Obtaining a blower of sufficient capacity (both volume and pressure) to deliver air under all normal requirements; screening out the small coke (to increase its permeability) by using a fork with tines at least 2½ in. wide, and using larger or bulkier scrap to open up the charge. It will be noted that all of the recommendations are directed toward obtaining more air (by volume). Correction of the one difficulty (iron flow) could be obtained by: Increasing taphole size, and increasing slag fluidity by addition of fluorspar or soda ash, but that would not correct the fundamental difficulty.

Wants To Make Tellurium Wash

Q.—We just have received small quantities of tellurium in both pellet and powder form, and wish to do some experimental work with that element. We are familiar with use of tellurium as a ladle addition, but would like information on forming a tellurium wash or coating which could be applied to the mold surface by brushing or spraying to harden or chill specific areas.

A.—Crout in the November, 1944 issue of FOUNDRY described the application of tellurium wash or coating to molds and cores to chill or densify specific areas of gray iron castings. Later Vadeboncoeur in *Transactions,* American Society for Metals, 1945, provided more information on use of the material in eliminating shrinky sections in diesel and automotive cylinder blocks and liners. More recently, Austin in the July, 1949 issue of FOUNDRY discussed the subject.

In Vadeboncoeur's article mention was made that the base material was a tellurium paste containing 20 per cent water and about 20 per cent Te, and indications were that the adhesive agent was bentonite. He stated that the paste was too powerful, and to obtain desired results it was diluted with water and plumbago wash. From the data given we believe that the following mixture will serve for the purpose mentioned: 2 grams Te, 11 grams bentonite, 5 grams silica flour, and 82 grams water. Dry materials are mixed thoroughly before adding water. The paste then is mixed with 400 cc plumbago wash with a specific gravity of 27° Be. Since Te tends to precipitate, the solution should be stirred well before use.

Austin mentions two washes. One is compounded by mixing in the dry state 32 per cent Te, 60 per cent silica, 6 per cent alumina and 2 per cent iron oxide. One pound of this mixture is well shaken with 4 qt water, and then plumbago is added with continued shaking until a density of 27° Be is obtained. Before use ¼-pint of core gum mixed with hot water to the consistency of molasses is added. The other mixture is composed of 50 grams Te powder, 200 grams silica smoke, and ½-pint commercial alcohol. Before proceeding too far in use of tellurium, it would be advisable to study the patent situation.

Sand May Be Cause of Defects

Q.—We are making manganese bronze ring castings 28 in. diam which require 4500 lb of metal. Small pit holes on the surface and internal porosity are difficult to eliminate. Castings are poured from the following mixture: Cu 58 per cent, Zn 39 per cent, ferromanganese 1.5 per cent, steel turnings 1.5 per cent and Al 1.00 per cent. The metal is melted in an open flame furnace. None of this form of defect appears in small castings poured from the same alloy.

A.—Since no difficulty has been experienced in securing satisfactory small castings, it would seem that the sand in the large mold is at fault. Either it is too fine, or some foreign material has been added. If the mold is dried in the oven, and if the bonding material contains sulphur, the casting will be porous. Your first line of investigation should be in this direction. The sand in a mold for a casting of the size indicated should be coarse and strong so that the mold will retain its shape and at the same time allow all generated gases to escape freely. Pitting results from an accumulation of gas between the surface of the mold and the molten metal.

Melting Borings in the Cupola

Q.—In our gray iron foundry in Puerto Rico we operate three 22-in. diam cupolas and a machine shop in which we produce a great tonnage of turnings and borings. At present we are throwing the scrap away, but would like to use it in our cupolas since raw materials are getting scarcer every day. Can you suggest methods for putting the turnings and borings in suitable form for melting?

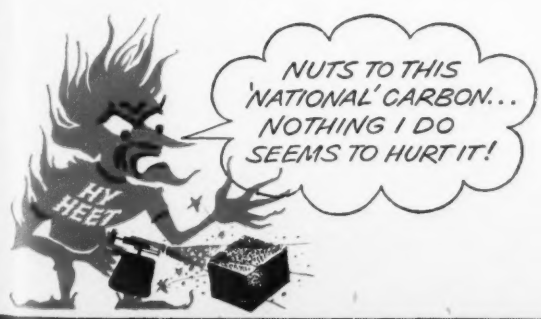
A.—Most suitable procedure for salvaging turnings and borings for melting in the cupola is to employ briquetting equipment. Such machines compress the borings and turnings into dense cylindrical briquets weighing from 3 to 11 lb which withstand the usual handling without breakage. Machines are available in several capacities based on the amount of material to be handled in a given period.

Past methods of using borings and turnings in the cupola involved placing them in wood boxes, tin cans or stovepipe, as well as just shovelling them into the cupola. However, the latter practice results in most of the material being spread over the country side due to the blast action. More recently, Reese mentioned that one foundry mixed 18 lb borings and turnings with 2 lb quick-setting portland cement to form a briquet which was allowed to dry for three days.

Information on briquetting machines may be obtained by writing to manufacturers listed in the Where-to-Buy section of FOUNDRY beginning on page 254.

The term "National" is a registered trade-mark of
NATIONAL CARBON DIVISION
UNION CARBIDE AND CARBON CORPORATION
30 East 42nd Street, New York 17, N. Y.
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
In Canada: National Carbon, Ltd., Toronto 4

15 blast furnaces in the U.S. have each produced over 1,000,000 tons of iron on a single "National" carbon lining . . . and are still going strong!



BLAST FURNACE LININGS • BRICK • CINDER NOTCH LINERS • CINDER NOTCH PLUGS • SKIMMER BLOCKS • SPLASH PLATES • RUNOUT TROUGH LINERS • MOLD PLUGS • TANK HEATERS

MEN *of Industry*

WILLIAM J. MacNEILL, the last two years assistant to the president, the Dayton Malleable Iron Co., Dayton, O., has been named foundry manager, Acme Aluminum Alloys, there. **James D. Claffey,** formerly associated with General Malleable Corp., Waukesha, Wis., has been appointed superintendent of the core department. Mr. MacNeill was general manager of the G.H.R. Foundry Division of Dayton Malleable Iron Co. from 1945 to 1949. Prior to that he was president-general manager, Federal Malleable Co., West Allis, Wis., which he joined in 1919. Mr. MacNeill is a former national director of the American Foundrymen's Society and served as president of the Wisconsin Chapter of that organization in 1939-40.

♦ ♦ ♦

Elmer J. Carmody, foundry engineer for the Charles C. Kawin Co., Chicago, has become identified with Engineering Foundry Inc., a new organization which is establishing a gray iron foundry at Cedar Springs, Mich. Mr. Carmody will serve as president but will continue in the foundry engineering work he has engaged in the last 12 years with the Kawin company. A graduate of Michigan State College, Mr. Carmody previously was connected with Saginaw Malleable Iron Co., Oliver Farm Equipment Co., Campbell, Wyant & Cannon Foundry Co., and Superior Engine Division of National Supply Co.

♦ ♦ ♦

Marvin W. Williams has resigned as foundry manager, Hughes Tool Co., Houston, Tex., to participate in the operation of Industrial Foundry Corp., a company recently organized there. Mr. Williams, a native Texan, was graduated from University of Texas in 1935, when he joined Hughes Tool Co.'s sales department. He became foundry manager in 1945. An active member of various technical societies, he served as chairman of the Texas Chapter of the American Foundrymen's Society during 1947-48.

♦ ♦ ♦

Arnold K. Steger, vice president, Hanford Foundry Co., San Bernardino, Calif., recently flew to Europe to spend a month with foundries in England and France as a consultant in the manufacture of centrifugal pump castings. Mr. Steger, for 35 years associated with the foundry industry, has specialized at Hanford Foundry for the past 6 years in development of complicated pump parts. During the past two years he has so improved pump efficiency by a new process of casting impellers, that he was engaged in a consulting capacity by European affiliates of Pacific Pumps Inc., Los Angeles, purchasers of castings from Hanford Foundry.

♦ ♦ ♦

Robert Shaffer, until recently associated with the Dayton Steel Foundry Co., Dayton, O., has been appointed special representative, Buckeye Tools Corp., there, working with field representatives in several midwestern and eastern states, and specializing in portable tool applications in the foundry industry. Mr. Shaffer, who joined Dayton Steel Foundry Co. 32 years ago, served 16 years as foundry superintendent and director of the company, and most recently as assistant factory manager.

♦ ♦ ♦

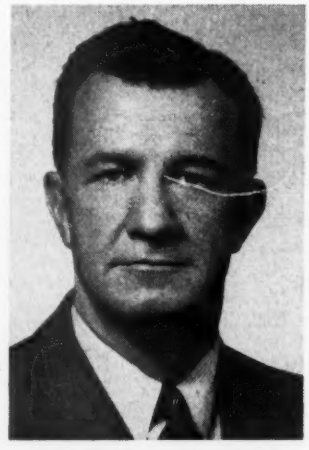
Raymond P. Brewer has been named vice president, treasurer and a director, Symington-Gould Corp., Depew, N. Y. Mr. Brewer, formerly secretary-treasurer, has been associated with the company 17 years. **James F. Thompson Jr.** has been appointed secretary.

♦ ♦ ♦

Walter H. Sarraf has been appointed to the Pittsburgh district sales staff, Harbison-Walker Refractories Co., there. Mr. Sarraf, a gradu-

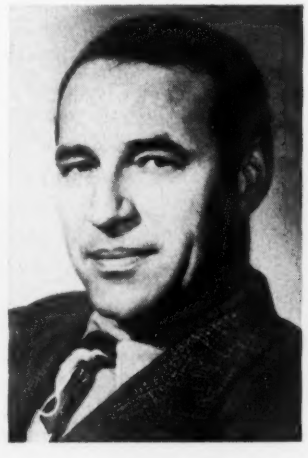
(Continued on page 112)

WILLIAM J. MacNEILL
. . . Acme Aluminum foundry mgr.



ELMER J. CARMODY
. . . heads Engineering Foundry

MARVIN W. WILLIAMS
. . . joins Industrial Foundry



ARNOLD K. STEGER
. . . consultant in Europe

To all our Good Friends in the Foundry Trade

We Extend Best Wishes

for a Happy and Prosperous

NEW YEAR

ON this the threshold of the New Year, we voice the hope that increased opportunities may be afforded us to be of service to our foundry friends. In the year ahead, as through the past 68 years, we shall devote our full facilities to the single end of making only UNIFORM WOODWARD PIG IRON.

WOODWARD IRON COMPANY

WOODWARD, ALABAMA

Independent Since 1882

GENERAL SALES OFFICE: 1515 First National Building • Birmingham, Alabama • Phone 54-1667

(*Continued from page* 110)
ate of University of Pittsburgh, has been associated with the company's sales department since 1930, as sales statistician and correspondent.

♦ ♦ ♦

A. C. Perks has been elected president and general manager of the Eclipse Fuel Engineering Co., Rockford, Ill., succeeding **H. P. Howell,** who has been made chairman of the board of directors. Mr. Perks formerly was executive vice president in charge of production. Other officials are: **J. H. Sands,** executive vice president, and **K. A. Scharbau,** treasurer and controller.

♦ ♦ ♦

Milton G. Peck has been appointed sales manager for the line of powered hand trucks recently introduced by Clark Equipment Co., Industrial Truck Division, Battle Creek, Mich. Mr. Peck was formerly associated in Philadelphia with Yale & Towne Mfg. Co. as sales manager of its Industrial Truck Division.

♦ ♦ ♦

A. C. Kukral has been named resident sales engineer for the Whiting Corp., Harvey, Ill., with headquarters at 637 Penton Bldg., Cleveland 13, where the company has opened a subsales office under supervision of H. E. Reynolds, district manager in Pittsburgh. Mr. Kukral, a graduate of Illinois Institute of Technology, joined Whiting in 1947 following Navy service. **R. E. Florine,** for the past 5 years sales engineer in Whiting's New York district sales office, has been appointed district manager in charge of engineered product sales in Washington, Oregon and Idaho, with headquarters at the office recently opened at 350 Skinner Bldg., Seattle. Mr. Florine is a graduate of Washington State College with a number of years of engineering and sales experience and two years as a Navy engineering officer during the war.

♦ ♦ ♦

Charles H. Nock, president, the Nock Fire Brick Co., Cleveland, recently observed his 78th birthday by continuing as active head of the company which he organized in 1912. The company has been warehousing

CHARLES H. NOCK
. . . observes 78th birthday

and distributing refractory products from the same location, 1243 East 55th St., since that date. Mr. Nock, a native of Cleveland, drives daily to his office. Associated with him in the business are his two sons, Ralph L. Nock, treasurer, and Gilbert J. Nock, vice president and secretary.

♦ ♦ ♦

George R. Siegrist, executive vice president-treasurer, Acheson Colloids Corp., Port Huron, Mich., has retired because of ill health and will make his home in Laguna Beach, Calif. Mr. Siegrist joined the company in 1911 and later was transferred to its European plants in Belgium, Italy and France. He returned to the Port Huron home office in 1920, became company treasurer in 1928 and was appointed executive vice president and director in 1932.

♦ ♦ ♦

Harold S. Falk, president, the Falk Corp., Milwaukee, was honored recently at the company's annual employee service dinner by presentation of a 50-year service pin. Mr. Falk joined the company following graduation from University of Wisconsin in 1906. He became vice president and works manager in 1920 and succeeded to the presidency in 1940, when his uncle, Herman W. Falk, became chairman of the board. Mr. Falk has been outstanding in the field of apprentice training, vocational education and labor-management relations.

♦ ♦ ♦

James Thomas for the past 30 years foundry superintendent Shenango-Penn Mold Co., Sharpsville, Pa., retired from active service Jan. 1, 1951. He has been connected with the foundry industry for 54 years and particularly interested in the production of cast iron ingot molds. Several contributions from his pen have been presented in FOUNDRY.

♦ ♦ ♦

Henry L. LeMay has been appointed Chicago district manager, Mid-West Abrasive Co., Owosso, Mich. Mr. LeMay has had a number of years of experience in the abrasive industry.

♦ ♦ ♦

John Williamson, formerly storekeeper, has been made materials control supervisor, Hunt-Spiller Mfg. Corp., Boston, succeeding **John E. Henry** who has resigned. Mr. Williamson, who joined the company in

(*Concluded on page* 115)

A. C. PERKS
. . . Eclipse Fuel president

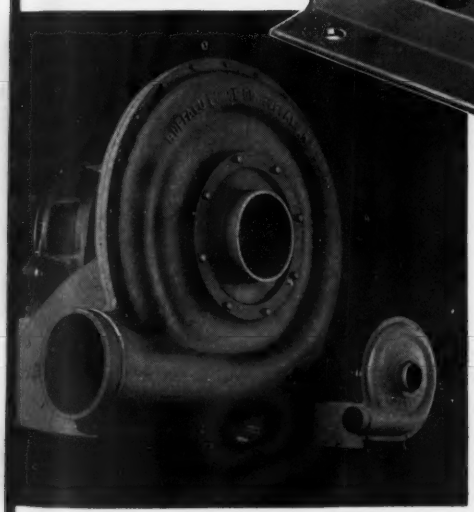
MILTON G. PECK
. . . sales mgr., Clark hand trucks

A. C. KUKRAL
. . . Whiting sales at Cleveland

R. E. FLORINE
. . . Seattle manager, Whiting

Rugged, Efficient CUPOLA BLOWER In A Small Package!

"Buffalo" TYPE "CB" PRESSURE BLOWERS



←"BUFFALO" "E" BLOWERS

For capacities up to 5500 c.f.m. and pressures up to 55.2″ of water, and a wide variety of smaller sizes, "Buffalo" Electric Blowers-Exhausters have constant characteristics over a wide range of capacity. Rugged, efficient, economically installed one-piece units.
WRITE FOR BULLETIN 3014-C

- *Single stage blowing*, 150 c.f.m. to 8000 c.f.m., up to 2¼ pounds pressure!
- Stronger, lighter, yet more efficient units than ever before!
- Dynamically balanced rotors of sturdy steel plate, riveted or welded—steel plate housing sides ribbed for extra strength!
- WRITE FOR BULLETIN 3553-A for complete description including dimensions and performance ratings.

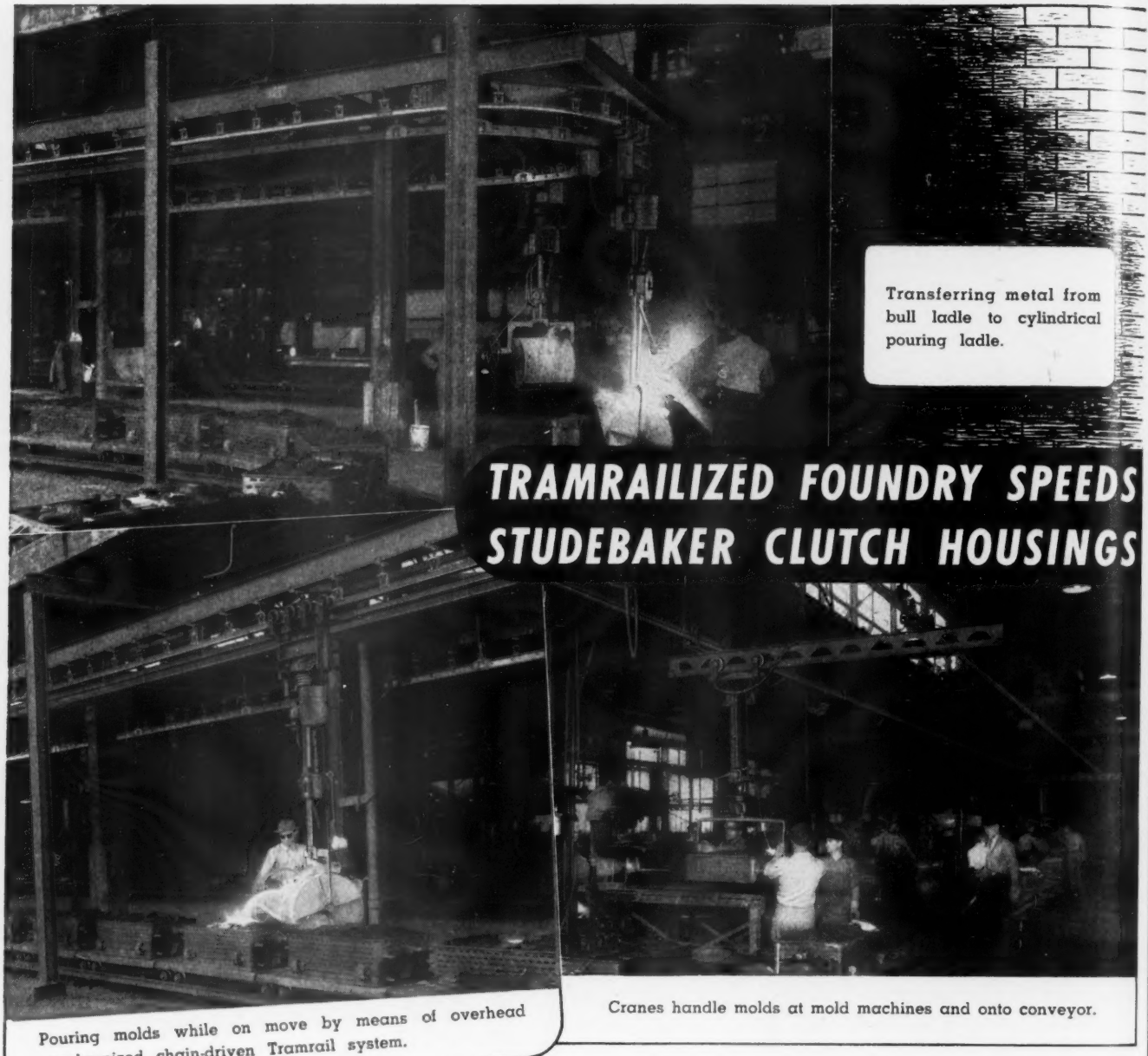
"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

221 MORTIMER ST. BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont., Branch Offices in all Principal Cities

VENTILATING · FORCED DRAFT · AIR WASHING · COOLING · AIR TEMPERING · HEATING · INDUCED DRAFT · EXHAUSTING · PRESSURE BLOWING



Transferring metal from bull ladle to cylindrical pouring ladle.

TRAMRAILIZED FOUNDRY SPEEDS STUDEBAKER CLUTCH HOUSINGS

Pouring molds while on move by means of overhead synchronized chain-driven Tramrail system.

Cranes handle molds at mold machines and onto conveyor.

● Cleveland Tramrail equipment is a primary factor enabling fast production of clutch housings in a special department devoted to this item at the Studebaker Corporation, South Bend, Indiana. Cranes with air hoists ease the work of mold preparation and handling onto the conveyor. A chain driven Tramrail system, on which the pouring ladles ride, is synchronized with the mold conveyor, permitting molds being easily poured while in motion. The rate of production is such that 138 cars pass a given point per hour. For the investment involved, no other foundry equipment offers as great possibilities for speeding production, reducing cost, easing the work and aiding safety as Cleveland Tramrail.

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BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
3815 EAST 286th ST. *WICKLIFFE, OHIO*

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

(*Concluded from page* 112)

1934, became employment manager in 1947 and storekeeper in 1949. **Alfonso Porzio,** associated with the company since 1946, has been named to succeed Mr. Williamson as storekeeper. **Louis R. Robinson,** who has been with the company since 1946, has been placed in charge of the cost control section.

♦ ♦ ♦

Wayne Belden has been elected executive vice president, Ajax Flexible Coupling Co., Westfield, N. Y. **Charles Belden** has been named vice president and **Robert G. Cady,** sales manager.

♦ ♦ ♦

Paul L. Arnold, who has been named chairman of the Tennessee Chapter of the AFS for 1950-51, is resident manager of the Chattanooga Works, U. S. Pipe & Foundry Co. Mr. Arnold served in the research department at the general office of the company in Burlington, N. J., from 1930 until the early part of 1945 and was assistant engineer the last 11 years of that period. About that time he joined the operating department and became superintendent of the Shell Division at Addyston, O., and was assigned to the Chattanooga Works in August, 1945. Mr. Arnold is also chairman of the Tennessee Chapter of the American Society of Mechanical Engineers.

♦ ♦ ♦

Gordon L. Leach has resigned as manager of the automotive division, Hunt-Spiller Mfg. Corp., Boston. He has been associated with the company for 20 years.

♦ ♦ ♦

Charles Wilson has been named chairman of the board of directors, Worthington-Gamon Meter Co., Newark, N. J., subsidiary of Worthington Pump & Machinery Corp., Harrison, N. J. **R. R. Anderson,** formerly vice president, succeeds Mr. Wilson as president and **William Flanders** has been named vice president.

♦ ♦ ♦

Dr. Robert F. Thomson has been appointed assistant head of the metallurgy department of General Motors Corp's research laboratories, Detroit. Dr. Thomson was formerly in the Detroit field office of International Nickel Co., New York.

ROBERT G. SCHAEFER

Elected vice president of the Gray Iron Founders' Society, as reported in December FOUNDRY

John T. M. Frey has been appointed assistant manager of the New York branch and **Lamar S. Hilton,** assistant sales manager of the abrasive wheel department, Manhattan Rubber Division, Raybestos-Manhattan Inc., Passaic, N. J. Mr. Frey has been a member of the division's sales organization for many years and Mr. Hilton formerly served as sales engineer.

♦ ♦ ♦

Joseph A. Conlon, formerly district sales manager, Chicago branch, has been appointed manager of allied sales for the mechanical goods division, United States Rubber Co., New York. **Edwin D. Meade,** who has been manager of Western railway sales, succeeds him in Chicago. Mr. Conlon has been associated with the company for 20 years and Mr. Meade for 15 years.

♦ ♦ ♦

Carl A. Koerner has been named production manager of General Motors Central Foundry Division's Defiance, O., plant. **Edmon W. Hunt,** formerly foundry superintendent, has been made shift superintendent; **Michael F. Vichich,** former Defiance finishing department general foreman, was made department superintendent, and **Richard A. Joerg** was transferred from the finishing department at Saginaw, Mich., to a similar position in the Defiance foundry. All four men were formerly Saginaw Malleable Iron Plant employees.

♦ ♦ ♦

A. H. Engstrom has been named acting engineering manager for piston rings manufactured by the Metal Products Division, Koppers Co., Baltimore, succeeding **Dr. Tracy Jarrett,** who has resigned because of ill health. Mr. Engstrom was graduated from University of Southern California. He joined the Koppers organization last February.

♦ ♦ ♦

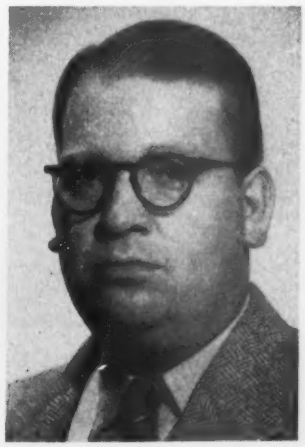
Carl G. Holmes has joined the Pittsburgh district sales staff of Harbison-Walker Refractories Co., there. Mr. Holmes, a graduate of Pennsylvania State College, has spent 18 years in insulating and refractory sales.

♦ ♦ ♦

C. A. Gordon has been named Buffalo representative with offices at 930 Prudential Bldg., for Laclede-Christy Co., St. Louis.

WAYNE BELDEN
. . . Ajax executive vice pres.

CHARLES BELDEN
. . . vice pres., Ajax Flexible



ROBERT G. CADY
. . . sales mgr., Ajax Flexible

PAUL L. ARNOLD
. . . heads Tennessee Chapter

Industry BRIEFS

DOUGLAS Foundry Co., subsidiary of Seattle Foundry Co., 3444 Thirteenth St., Seattle, is constructing a new foundry in Douglas, Ariz., at a cost of $300,000, for production of steel balls used in ore grinding mills for the Arizona mining industry. New foundry will be equipped for production of steel castings formerly shipped from other areas.

* * *

Gardner-Denver Co., Quincy, Ill., has established a Canadian plant at Brantford, Ont., to provide increased service for its users of rock drills, air compressors, pumps, etc., there. The new plant will be operated by Gardner-Denver Co. (Canada) Ltd., Toronto, Ont., with production handled through its seven Canadian branch offices.

* * *

Morris Bean & Co. has completed construction of an aluminum precision molding foundry at Yellow Springs, O., consolidating activities carried on at two previous locations there. The new foundry, with over 60,000 sq ft of floor space, completed at a cost of $600,000, makes aluminum castings for the aircraft industry utilizing the Antioch process developed by Morris Bean, president of the company.

* * *

Hadco, Ninth & 99 Highway, Delano, Calif., has appointed Dore Foundry, Beloeil, suburb of Montreal, Que., to handle manufacture and sale of cast iron fittings, invented and patented by George F. Haddican, owner of Hadco. The Dore foundry will manufacture Hadco fittings using patterns from the Haddican foundry.

* * *

H. K. Porter Co., 1932 Oliver Bldg., Pittsburgh 22, has announced formation of Jarecki Valve Division, Tulsa, Okla., to handle manufacture and sale of valves formerly produced at Jarecki Mfg. Co., Erie, Pa., which the company acquired last year. Valves formerly manufactured by the Jarecki company will now be produced in the parent company's Hinderliter Tool Co. Division plant in Tulsa.

* * *

Chemalloy Foundry Inc., 1400 North Carolina St., Louisiana, Mo., has begun construction of an addition which will contain 10,000 more square feet of floor space, to be used as a smelting plant. Company has also rented floor space in the Nickles building there to be used as a laboratory for metal analysis.

* * *

Century Foundry Co., 3727 Market St., St. Louis, on Nov. 3, suffered fire loss estimated at $90,000 when fire of undetermined origin destroyed furnishings and equipment in the pattern storage shop and casting shop beneath it.

* * *

Saunders Castings Inc., Wichita, Kans., has been incorporated with $100,000 capital, to manufacture metal castings. Incorporators are R. E. Saunders, John W. Rix and Lenore B. Saunders, all of Wichita.

* * *

Clifford Salsbury has sold his interest in J. & S. Foundry Inc., Dewey, Okla., and has opened a new foundry in Tonkawa, Okla., for the manufacture of gray iron, aluminum, brass and bronze castings.

* * *

Eastern Foundry Supplies Inc., has moved its offices to larger quarters at 109 Frelinghuysen Ave., Newark 5, N. J. The plant and warehouse will continue at 500 Chancellor Ave., Irvington 11, N. J.

* * *

Laclede-Christy Co., Ambassador Bldg., St. Louis, has moved its executive, fiscal and operations offices to 310 South Michigan Ave., Chicago 4. General sales office is in the Iroquois Bldg., 3600 Forbes St., Pittsburgh.

* * *

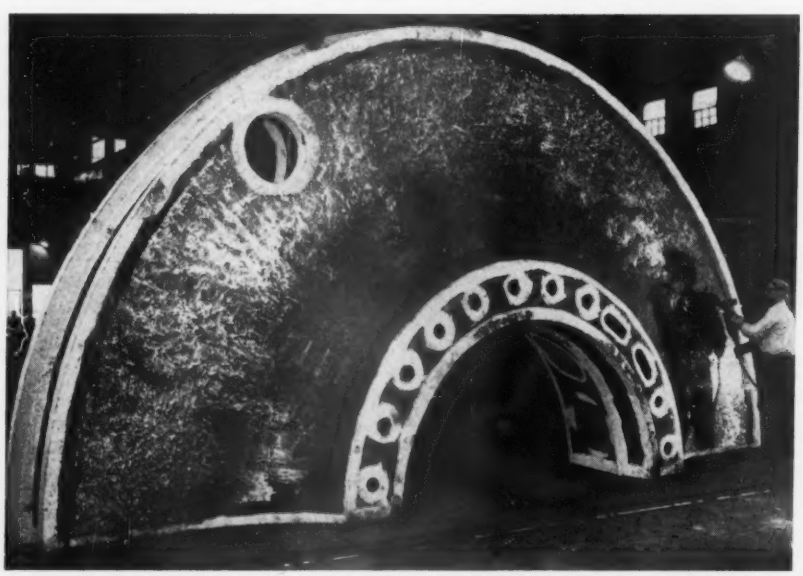
O. W. and M. W. Potter, 1803 Princeton Ave., St. Paul 5, Minn., have been appointed representatives of the Ironton Fire Brick Co., Ironton, O., for the state of Minnesota.

* * *

Cole Pattern & Engineering Co., formerly located in Garrett, Ind., has moved to R.R. 1, Lima Rd., Fort Wayne, Ind., where floor space and shop facilities have been increased.

* * *

Manhattan Rubber Division, Raybestos-Manhattan Inc., Passaic, N. J., has moved its New Orleans office and warehouse from 1009 Camp St. to 920 Calliope St.



INNER COVER PLATE half-section for a hydro-electric turbine installation at Pickwick Dam, Tenn., part of the Tennessee Valley Authority, is a 66,000-lb steel casting, measuring 25½-ft. in diam. It is being dressed by man at the right with a pneumatic hand grinder at the Bethlehem, Pa., plant of Bethlehem Steel Co.

M & H VALVE & FITTINGS CO., ANNISTON, ALABAMA

THIS COMPANY was started in 1925 to create a new industry in Anniston. It is owned and operated by residents of that city thereby giving it a unique community atmosphere. Starting with 60 employees, it has grown to a point where 350 people are gainfully employed, turning out quality iron body valves and fittings for public utilities and industrial applications.

Plant area is 13 acres and the foundry was completely mechanized in 1946. It is equipped with complete sand handling and control equipment. Automatic shakeouts and modern conveyors are used.

Long-term employment of the bulk of its people demonstrates management's continual interest in their welfare.

Herman Molding Machines, ranging from 750 to 6000 lb. capacities, have helped make it a good place to work since the early 30's. Today they are responsible for fast, smooth production of about 600 — 700 tons of castings per month. The 750 pound jarr rollover illustrated, like all Hermans, is ruggedly built; has pressure lubrication to each moving part; develops fast, smooth hydraulic rollover and pattern draw; and its complete operation is controlled by one rotary valve handle.

Herman **MOLDING MACHINES**

HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH, PA.

STEEL FOUNDERS' T. AND O. CONFERENCE

Emphasizes Product Development

PRACTICAL application of research and product development activities is the key to improved steel casting production and the solution of many engineering design problems, it was reported at the fifth annual Technical and Operating Conference of Steel Founders' Society of America.

The gathering of technical, operating and management executives of the industry, established a record with 384 registrations, according to F. Kermit Donaldson, executive vice president. Continuous sessions were held in the Hotel Carter, Cleveland, Nov. 9, 10, and 11.

During the three days more than 30 technical papers, individual and round-table discussions arranged by Charles W. Briggs, technical and research director, and the 11-man Technical and Operating Committee, were presented.

As chairman of the national committee, L. A. Kleber, assistant vice president in charge of manufacturing, General Steel Castings Co., Granite City, Ill., opened the conference with summary reference to the far-reaching significance of the society's comprehensive research and product development programs.

First technical session, with R. C. Wood, vice president, Minneapolis Electric Steel Castings Co., Minneapolis, and M. T. MacPherson, plant engineer, Symington-Gould Corp., Depew, N. Y., presiding, dealt with "Product Development and Casting Engineering."

Preliminary to these discussions was initial showing of a motion picture providing an exceptional visual record of the actual mechanics of "The Flow of Molten Steel in Sand Molds—Part 2." Filmed in color, the movie was produced by Armour Research Institute as the second part of Research Project No. 18 sponsored by the society. The film permits observation of metal flow patterns in actual pouring of castings in which the number, diameter, and distance of sprues, gates and runners, pouring temperatures, etc. are varied.

Launching the discussions of engineering-based product development, Arthur S. Breithaupt, vice president, Dodge Steel Company, Philadelphia, spoke on "Profits and Good Will Through Product Development." Product development should be divided into two phases, he said: (1) Intelligent conversion to steel castings of parts made by competing materials and those made by means of fabrication; and (2) redesigning of existing steel casting designs to foundry-engineered products for more economical production and greater serviceability.

Various examples of conversion from other types of material and fabricating methods to steel castings were cited by the speaker. Other instances of redesign and cast-weld construction were described by A. H. Suckow, metallurgist, Symington-Gould Corp., Depew, N. Y., A. L. Wentzel, works manager, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., and R. C. Nelson, plant superintendent, Pacific Steel Castings Co., Berkeley, Calif.

"Statistical Quality Control Procedures" was the topic variously treated by four speakers in the following half-day session headed by M. T. McDonough, melting superintendent, National Malleable & Steel Castings Co., Sharon, Pa., and F. X. Hohn, assistant works manager and chief metallurgist, Scullin Steel Co., St. Louis.

Describe Plant Methods

Methods employed at the speakers' plants were described by: C. R. Burdick, superintendent of manufacturing quality control, Ford Motor Co.; H. H. Johnson, metallurgist, National Malleable & Steel Castings Co., Sharon, Pa.; W. R. Punko, superintendent of metals, Wehr Steel Co., Milwaukee, and D. Meves and J. Ferrell, West Michigan Steel Foundry Co., Muskegon, Mich.

One half-day was devoted to discussions of resin and plastic core binders in sessions at which V. E. Zang, vice president in charge of research, Unitcast Corp., Toledo, was chairman, and Hubert Chappie, foundry superintendent, National Supply Co., Torrance, Calif., was assistant chairman. Subjects covered were:

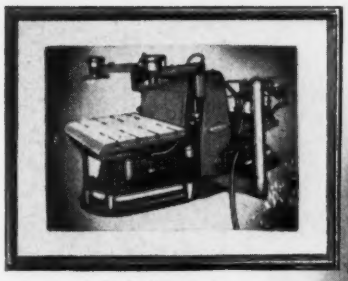
"Evaluation and Application of Phenolic Resin Core Binders," John Rassenfoss, American Steel Foundries, East Chicago, Ind.; "Evaluation of Resin Core Binders," H. A. Ziebell, Crucible Steel Casting Corp., Milwaukee; "Observations and Experiences When Using Phenolic Resin Core Binders," H. W. Meyer, General Steel Castings Corp., Granite City, Ill.; "The Evaluation and Practical Use of Liquid and Dry Resin Binders," William Downey, Burnside Steel Foundry Co., Chicago; and "Plastic Bonded Thin Shell Sand Molds," B. N. Ames, Material Laboratory, N. Y. Naval Shipyard, Brooklyn.

One high spot of the conference was a "Do You Know?" panel session. D. F. Sawtelle, metallurgist, Malleable Iron Fittings Co., Branford, Conn., presided. A feature was the presentation to each member in the audience of a quiz sheet listing 14 categorical statements relating to hot tear formation. Subsequently, seven speakers dealt separately with each numbered true-or-false statement, explaining the basis of the correct answer, and tying the discussion to published research findings of the society.

Speakers on the panel were R. M. Anson, metallurgist, Crucible Steel Casting Co., Lansdowne, Pa.; C. D. Berry, works manager, Hartford Electric Steel Corp., Hartford, Conn.; E. H. Berry, chief metallurgist, Dodge Steel Co., Philadelphia; A. L. Proctor, metallurgist, Bethlehem Steel Co., Bethlehem, Pa.; L. M. Townley, assistant metallurgist, Adirondack Foundries & Steel Inc., Watervliet, N. Y.; C. B. Jenni, works metallurgist, General Steel Castings Corp., Eddystone, Pa.; and C. W. Briggs, technical and research director of the society.

Repair welding procedures occupied the attention of final sessions of the conference, at which C. E. Silver, works manager, Texas Electric Steel Casting Co., Houston, presided, and M. T. MacPherson, plant engineer, Symington-Gould Corp., Depew, N. Y., was assistant chairman.

Subjects covered by the following speakers were: "Procedures for Repair Welding," R. D. Williams, Battelle Memorial Institute, Columbus, O.; "Controlled Repair Welding on Steel Castings," R. C. Heaslett, Continental Foundry & Machine Co., Coraopolis, Pa.; "The Semi-Automatic Weld Repair of Steel Castings," Sidney Low, Chapman Valve Mfg. Co., Indian Orchard, Mass.; "Casting Repair by Submerged Arc Welding," T. W. Berquist, United Engineering & Foundry Co., New Castle, Pa.; and "Submerged Arc Welding Applied to Steel Casting Repair," A. E. Blake, General Electric Co., Everett, Mass.



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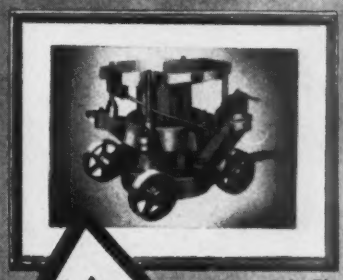

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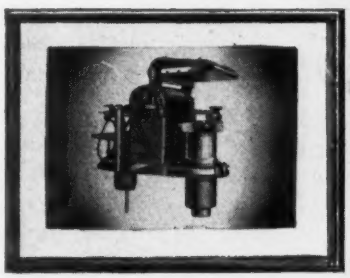

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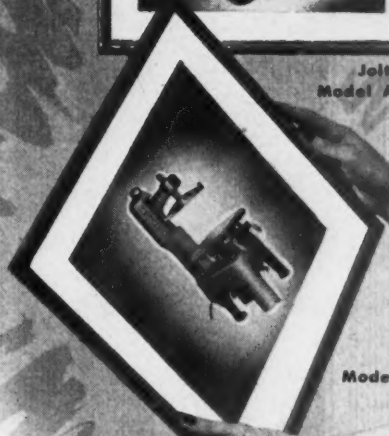

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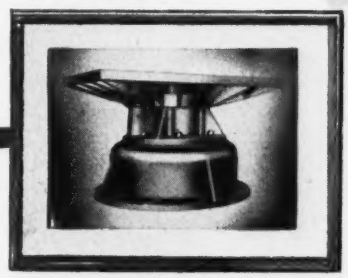

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ABC of Foundry Practice

CARBON AND ITS EFFECT ON CAST IRON

By DONALD J. REESE, International Nickel Co., New York

PURE iron, like pure gold, is soft. If this quality of softness could not be changed, iron's industrial use would be lessened. The properties of metals, however, can be altered greatly by alloying them with other elements. The properties of iron, for example, are altered greatly by alloying iron and carbon. Steel is a binary (two-component) alloy of iron and carbon, in which the percentage of carbon may be as little as 0.05 per cent or as much as 1.7 per cent, although in most engineering steels the percentage of carbon is usually 0.15 to 0.45 per cent. Cast iron is a ternary (three-component) alloy of iron, carbon and silicon. As cast iron is a more complex alloy than steel and therefore more difficult to understand, it is sometimes referred to as "steel interspersed with graphite."

Whereas pure iron is a metallic element weighing 490 pounds per cubic foot and melting at 2795° F, carbon is a nonmetallic element weighing 138 pounds per cubic foot (in graphite form) and it has no melting point. It boils at 8721° F. Carbon is found as the free element in nature, one of its rare forms being the diamond. Anthracite coal and bituminous coal are other forms of carbon. A common material in the foundry is "plumbago" or "black lead" used as coating for mold and core surfaces. This form of carbon is also found free in nature.

In the ternary iron-carbon-silicon alloy called "cast iron" carbon and silicon are complementary elements. When there is very little or no silicon present and when the iron is above 2068° F in temperature, iron can dissolve from 4.3 per cent to as much as 5.5 per cent carbon at 2912° F. As the silicon content increases, the amount of carbon decreases. An approximate relationship between these complementary elements is shown in the carbon-silicon analyses for various pig irons containing very little silicon up to 17 per cent silicon.

Pure iron has a tensile strength of approximately 36,000 psi and a brinell hardness number of 75. When it is alloyed with carbon, the tensile strength increases up to 400,000 psi and the brinell hardness increases up to 600. The tensile strength of the various types of cast iron range from 20,000 to 100,000 or more psi and the brinell hardness may be as low as 150 or more than 650. Whether cast iron is weak or strong, soft or hard, depends mainly on the amount and on the form of carbon in the alloy. The amount of carbon in cast iron may be as little as 1.7 per cent or as much as 4.3 per cent, but the normal amount is close to 3.3 per cent. But as we have already noted, pure iron weighs 490 pounds per cubic foot and carbon (graphite) weighs 138 pounds per cubic foot. Carbon is usually present in two forms, combined carbon and free graphite; and to complicate the matter further, free graphite may be in the form of "flake" graphite or "nodular" graphite. Hence, we can readily understand that carbon can greatly affect the quality of cast iron.

C-Si Relationship in Pig Iron

Per Cent Silicon	Per Cent Carbon
2	4.1-4.2
4	3.5-3.6
6	3.0-3.1
8	2.4-2.5
10	1.9-2.0
12	1.4-1.5
14	0.9-1.0
16	0.8-0.9
17	0.7-0.8

Combined carbon is a chemical compound called cementite (Fe_3C) containing 1 pound of carbon to each 14 pounds of iron. In the engineering or readily machinable types of cast iron the amount of combined carbon should be less than 0.8 per cent. Some types of cast iron are "chilled" irons or "white" irons. That is, they exihibit a white fracture instead of the usual light or dark gray fracture. In the chilled or white areas of these cast irons, all of the carbon present, even if it amounts to 3.3 per cent, is in the combined form, and the irons are normally considered hard to machine. The brinell hardness number would normally be 500 to 650. In the machinable grades of cast iron containing less than 0.8 per cent combined carbon, the brinell hardness number would normally be 175 to 275.

When a carefully polished section of cast iron is examined under the microscope at 100 magnifications, "flake" graphite looks similar to a snow flake while "nodular" graphite is spherical, like a rubber ball. We have already considered that cast iron might be referred to as "steel interspersed with graphite" and now we can understand that there should be considerable difference in the mechanical properties of the material depending on whether this "interspersed graphite" is flake graphite or nodular graphite.

For example, when malleable iron is cast it is a white iron. All of the carbon is in the combined form, and the material is very hard and has no ductility. This material is made malleable by an annealing or heat treating process which precipitates all or nearly all of the carbon as nodular graphite. The annealed material is quite ductile with an elongation of 10 to 25 per cent. When graphite precipitates as "flake" graphite in cast iron, the material has some ductility but elongation may only be 0.5 to 3.0 per cent.

Comparatively recently procedures have been developed for the precipitation of free graphite in spheroidal or nodular form in the as-cast state through additions of cerium, and of magnesium to molten iron of low sulphur content. Other agents which give similar results include calcium, lithium, barium and strontium, but these have not been developed on a commercial scale. In the as-cast state such irons have tensile strengths ranging from 60,000 to 90,000 psi and over, with elongations of 15 to 2 per cent. An annealing treatment at high temperature for a short period increases the elongation with a consequent decrease in tensile strength.

We have considered a cast iron of 3.3 per cent total carbon and stated that in the machinable grades of cast iron the combined carbon content should not exceed 0.8 per cent. The difference between 3.3 per cent total carbon and 0.8 per cent combined carbon (or less) would mean 2.5 per cent free graphite (or more). The

(*Continued on page* 124)

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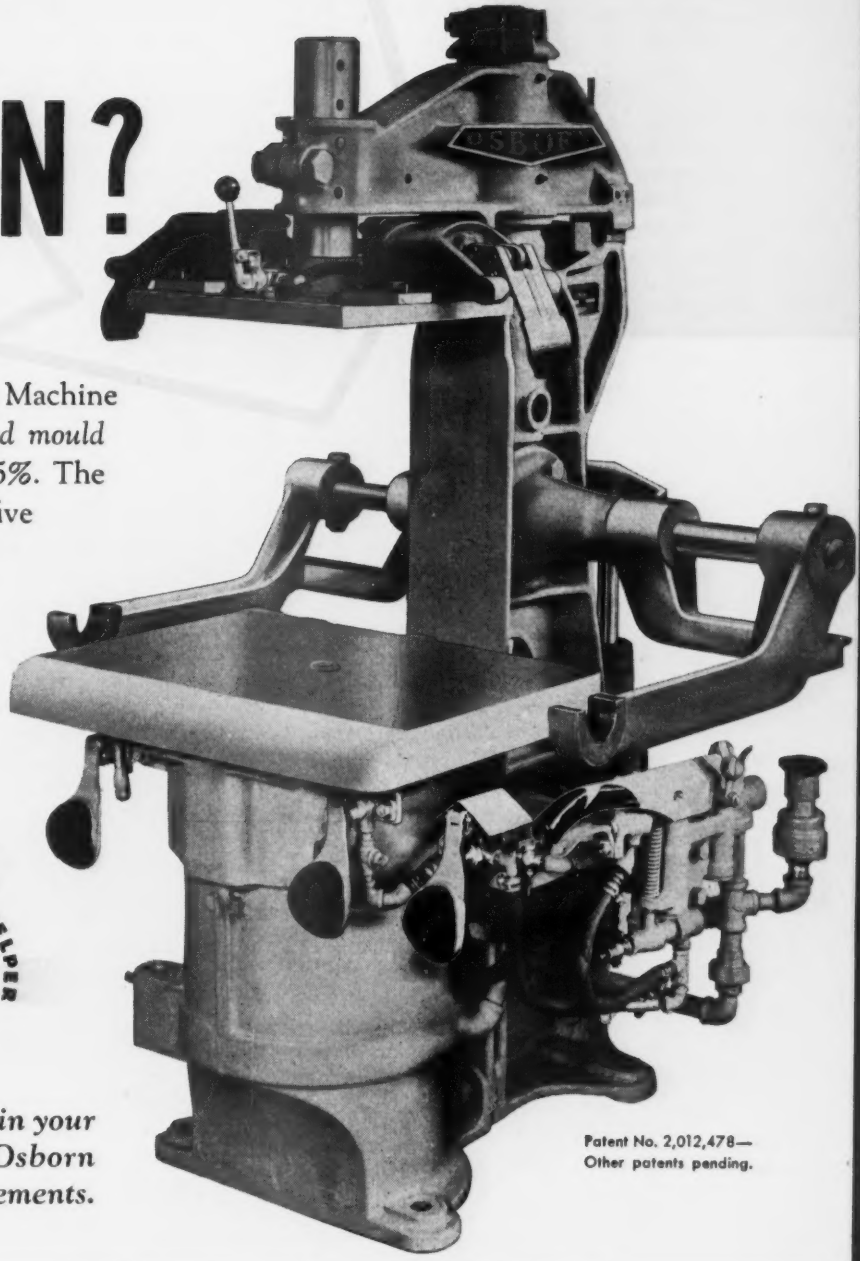

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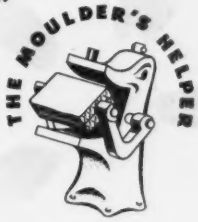

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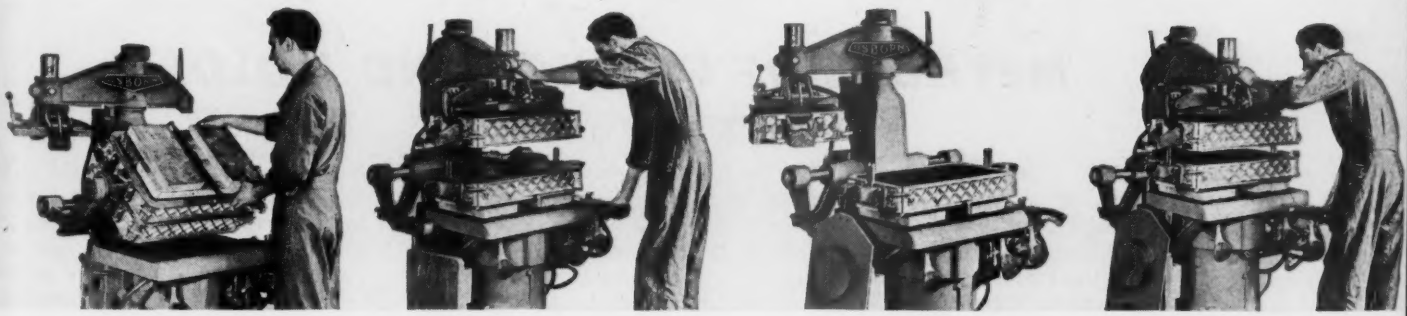

Rolling Over | Drawing Cope | Handling Cope | Closing

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MOULDING MACHINES CORE BLOWING MACHINES

MANUFACTURER'S ASSOCIATION, INC. FOUNDRY EQUIPMENT

ABC of Foundry Practice . . .

(*Continued from* page 121)

chemical laboratory reports the 2.5 per cent free graphite, by weight, but we have noted that iron weighs 490 pounds per cubic foot while graphite weighs only 138 pounds per cubic foot. Therefore, a cast iron containing 2.5 per cent graphite by weight would contain much more by volume—about 3.5 times as much or 8.75 per cent graphite by volume.

Whereas the influence of carbon in the binary iron-carbon alloy called steel is proportional to the amount of carbon present, the influence of carbon in cast iron depends, (1) on the amount of carbon, (2) on the proportion of carbon in the combined and graphitic forms, (3) on whether the shape of the graphitic form is "flake" or "nodular," and (4) on the specific gravity or volumetric influence of graphite.

When iron and coke are charged into a cupola, metal is exposed to carbon during the complete melting operation and some of the carbon intended to serve as fuel dissolves in the metal. As we have noted that carbon is a most important element in cast iron we should also note that the quality of carbon in cast iron is associated with the type of furnace in which the material is melted. Before the characteristics of the cupola furnace were known, the carbon content of metal melted in the cupola was usually high (3.4 to 3.7 per cent) and it was not known that the amount of carbon in cast iron could be controlled within the range of 2.0 to 3.8 per cent. The foundryman, unable to control carbon, adjusted the silicon content, using low silicon of about 1 per cent for heavy section castings and higher silicon of about 2.5 to 3.0 per cent for very light section castings.

Even though we now recognize the extreme importance of carbon in cast iron and know how to control carbon to the desired quantity with cupola melting, only a small percentage of gray iron foundries use this knowledge. Although the amount of carbon in cast iron is only one of four factors, we can readily understand that a combination of using good cupola operation with good selection of materials in the cupola metal charge will permit a skilled cupola operator to control carbon.

The proportion of combined and graphitic carbon depends upon at least five factors:

1. Composition of the mixture, particularly as to silicon and total carbon present.
2. Rate of cooling.
3. Influence of certain elements that may be present, such as chromium, hydrogen and others.
4. Ladle inoculation.
5. Heat treatment.

The greater the amount of total carbon present, the greater the proportion of graphite to combined carbon. The greater the amount of silicon present, the greater the probability of more graphite. The faster cast iron cools in the mold the greater the proportion of combined carbon to graphite. Certain elements tend to form carbides (combined carbon) or retard the decomposition of combined carbon, and when these elements are present they increase the proportion of combined carbon to graphite. Inoculation is the process of adding some material to molten gray cast iron in the ladle for the purpose of controlling the structure to an extent not possible by control of chemical analysis and other normal variables. This technique often increases the proportion of graphite to combined carbon. When castings are too hard to machine, which means the combined carbon is too high, they may be heat treated by holding in a furnace at 1600° F to decrease the amount of combined carbon. This is called annealing.

We have made reference to combined carbon and stated that it is a chemical compound Fe_3C. In the structure of cast iron, the metallurgist refers to this iron carbide as cementite. When the amount of carbon in the combined form is less than 0.8 per cent, the structure of cast iron contains pearlite, laminated structure of alternate layers of cementite and ferrite iron. The structure of cast iron may be wholly pearlite (except for graphite) at 0.8 per cent combined carbon but at lower combined carbon the structure may include ferrite. Ferrite is iron containing only 0.01 per cent carbon in which other elements, particularly manganese and silicon, are dissolved. When ferrite is relatively pure iron it has a tensile strength of 36,000 psi. Pearlite has 120,000 psi tensile.

When the combined carbon in cast iron exceeds 0.8 per cent, which is enough combined carbon to produce a completely pearlitic structure, the excess amount of combined carbon is referred to as massive cementite. Thus a "chilled" iron or a "white" iron, in the white areas, has massive cementite structures.

Austenite is a solid solution of carbon (0.8 to 1.7 per cent) in gamma iron. When certain alloys, nickel or chromium are added to cast iron in sufficient amount they produce austenitic structures in cast iron.

All cast irons have an austenitic structure above 1333° F, but austenite decomposes below this temperature unless the iron contains elements which prevent or delay such decomposition or it is rapidly quenched in oil or water. With slow cooling austenite decomposes to pearlite; with rapid cooling austenite decomposes to the acicular structure or martensite, and with quenching (extremely rapid cooling) austenite may be retained.

METHODS OF GATING SAND MOLDS

By PAT DWYER, *Engineering Editor, FOUNDRY*

ON CERTAIN types of castings the shape, size, position and number of gates are not particularly important. In other instances—and they constitute the majority—each or all of these are factors of major importance and exert a direct bearing on the resulting casting.

Wherever possible, a single gate of minimum cross-sectional area is preferable to any other style, if for no other reason than the savings in metal and in time required to remove the stump in the event the metal in the gate did not break away clean from the casting. Usually where the gate forms part of the pattern, this feature is taken care of by slightly nicking the gate on the cope side at the point where it touches the pattern. The gate then will break away clean from the casting.

To reduce costs some castings having an open surface and made for the use of the foundry are cast in open sand molds. The same method might be employed to advantage on many other castings. The pouring basin on an open sand mold is built slightly above the level of the casting; it drains clean, leaving no gate.

Complete unanimity of opinion on gating methods never has obtained among foundrymen. In stoveplate, hollow ware and sanitary ware shops metal is poured through various types of gates. Some types are shown in Fig. 1. However, it is interesting to note that a change of sand incidental to a change from hand to machine molding frequently is sufficient to

(*Concluded on page* 126)

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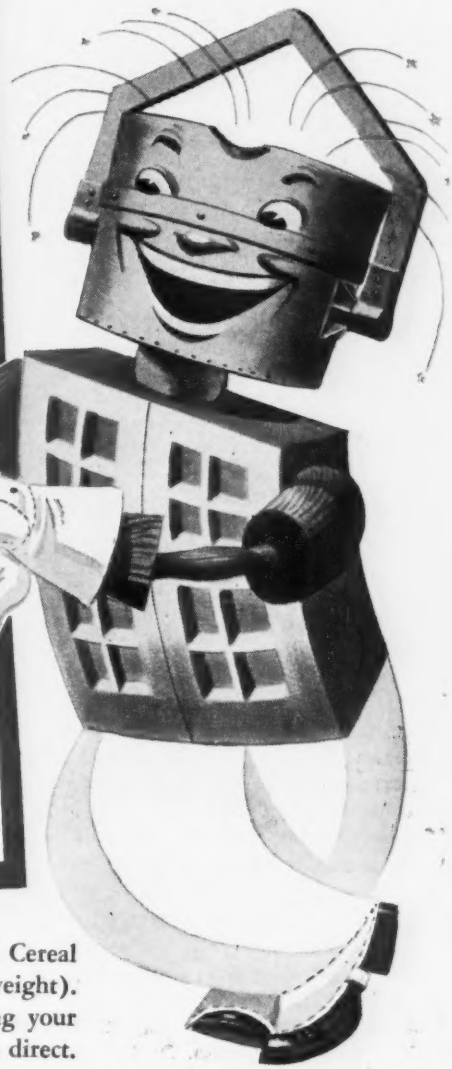

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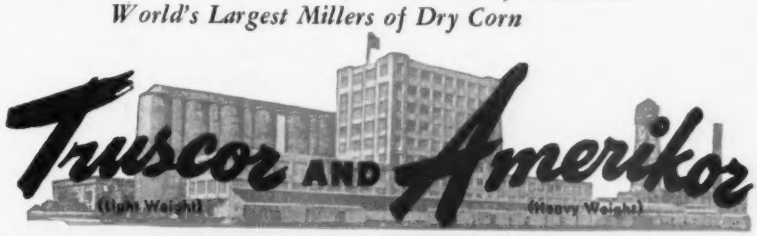

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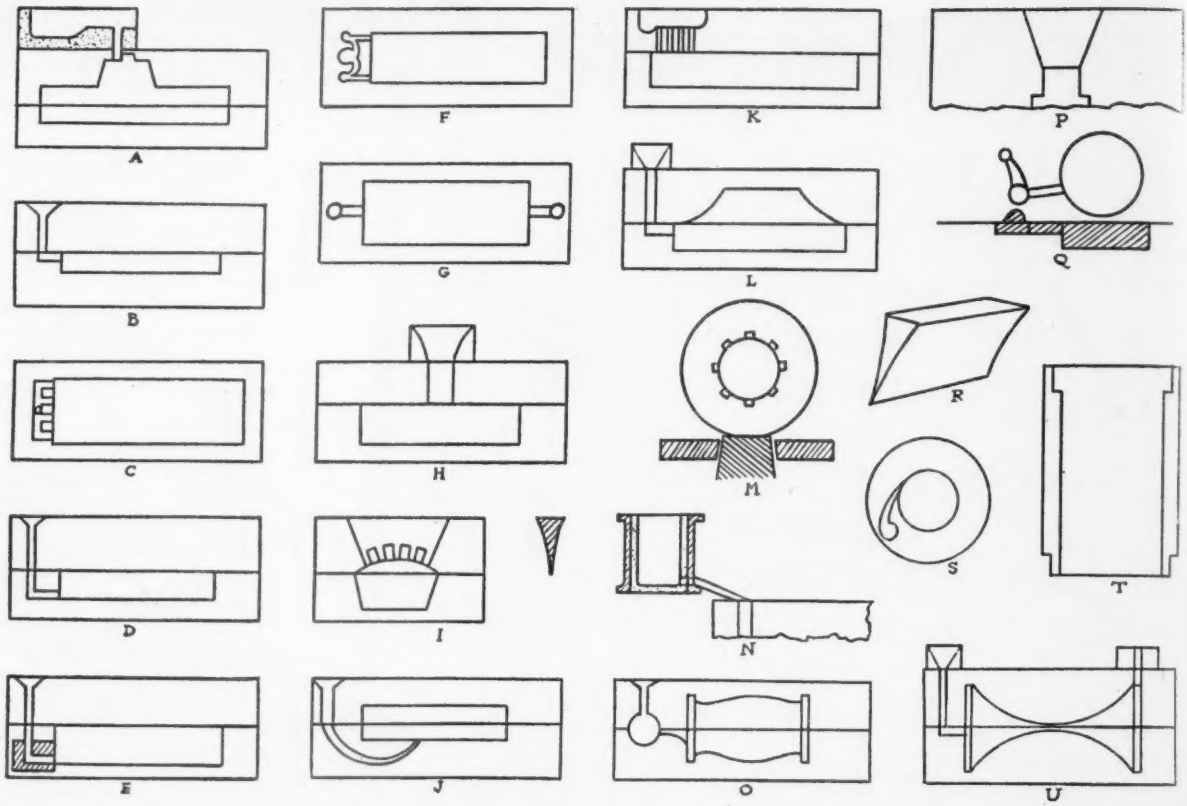


Fig. 1—Examples of gates, runners and risers. *A*—Pouring basin or top gate. *B*—Single or small gate. *C*—Branch gate. *D*—Bottom or in gate. *E*—Core gate. *F*—Skimmer or set gate. *G*—Double gate. *H*—Riser, head or feeder. *I*—Finger gate. *J*—Horn gate. *K*—Strainer, pencil gate or pop gate. *L*—Large gate. *M*—Ring gate. *N*—Reservoir. *O*—Shrink bob. *P*—Sink head. *Q*—Storage gate, runner or dirt catcher. *R*—Wedge gate. *S*—Whirl gate. *T*—Tile. *U*—Pouring cup and whistler

(*Concluded from page* 124)

convert the most ardent advocate of one style of gating to a method he formerly condemned. In this instance it is apparent that contributory factors and not the type of gate were responsible for the original belief.

Fire pots, bath tubs and other somewhat similar castings with high, thin walls may be properly gated on the top in some grades of sand. With other sands these castings can be made successfully only if gated at or near the bottom. In the first instance the casting quite safely might be gated at the bottom, but the top gating method is simpler and more economical, therefore it is continued. In the second instance, if the casting is gated at the top, the flowing metal will wash away some of the sand in its descent and the result is a rough, scabby casting.

In general a molding machine packs the sand to a greater density than is usual with hand molding and for that reason the sand employed for machine molding is lower in bond and higher in permeability than the sand on the hand molding floors. Consequently, it is t o u g h e r and better adapted to resist erosion from the flowing stream. Also, its high permeability permits the ready escape of moisture through the proper channels instead of through the face of the mold with resulting scabs, blisters, cold shuts and bubbles.

Cutting action of molten metal is greatest at the bottom of a sprue where the stream changes direction. If the sand in this area is rough, the metal will wash some of it into the mold. In some cases a certain amount of sand is washed into the mold through a boiling action set up in the metal from contact with wet sand. Where the dirty spots are caused only by sand washed up from the interior of the mold, or sand carried in from a dirty runner, sprue or gate, the cavities will be filled entirely with sand, sometimes free, sometimes in a partly fused condition. Where the trouble is due to metal boiling from a hard core, a core from which the gas cannot readily escape inward, cavities due to gas bubbles will show in addition to the sand.

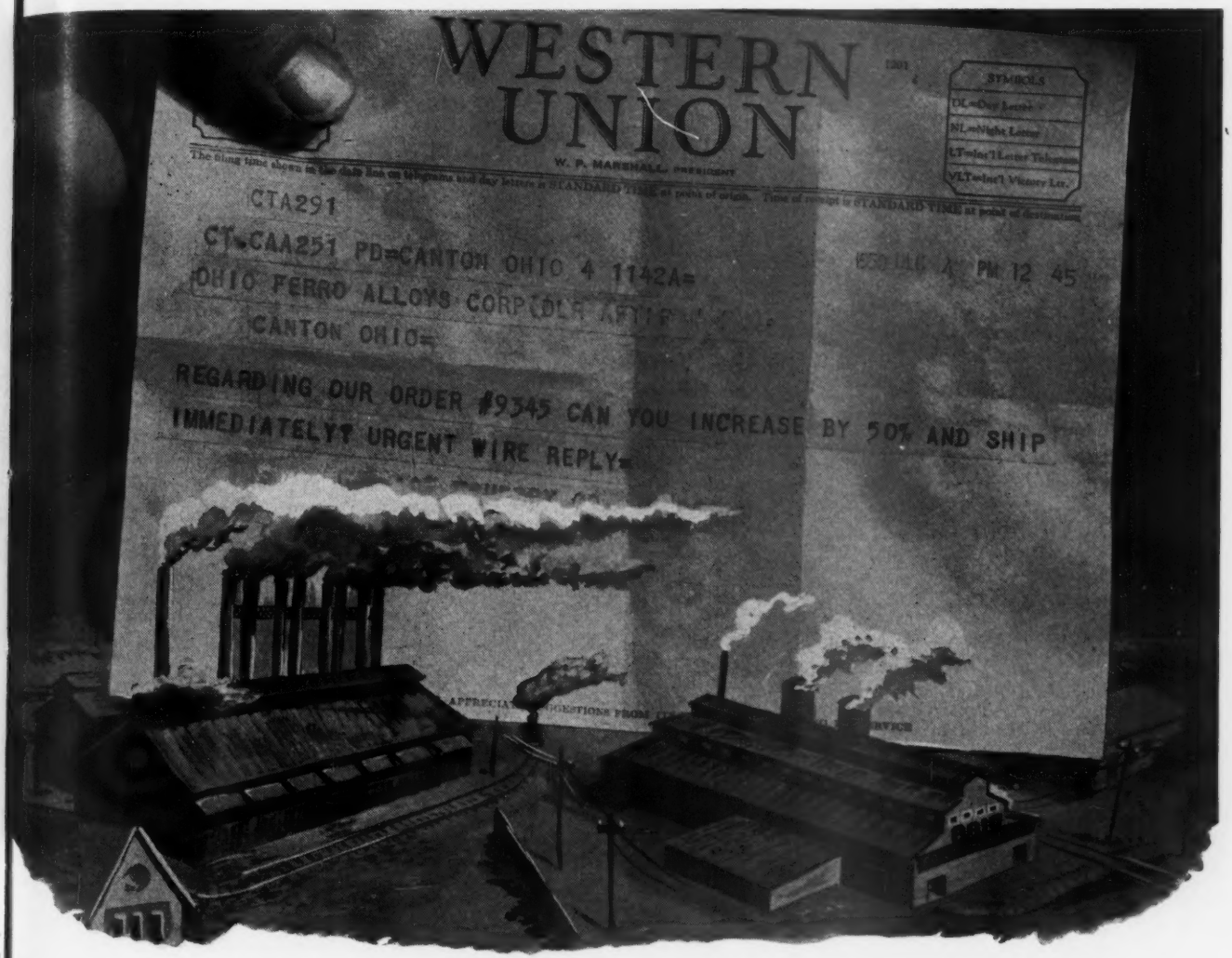
Proponents of top pouring claim that if the runner basin is kept filled, the metal entering the mold should be as clean as the iron entering the mold from any type of skimmer gate at the side. Further, the hot metal dropping from a number of small pop gates will have a tendency to loosen any dirt that may be clinging to the wall of the mold or core. Under certain conditions heavy castings may be made in a copeless mold and then any dirt that appears may be kept floating by the application of the end of a small rod.

If, for any reason, the casting must be poured under a cope, it is probable that a group of small pencil gates will serve more satisfactorily than either a single gate near the top edge or a somewhat similar gate at or near the bottom. However, no type of gate will prevent the formation of dross in the mold itself if the mold and core are not perfect. For this reason the open mold for many types of ring castings is favored by many foundrymen. Shrinkage and sullage are taken care of by extending the mold upward a certain distance beyond the normal length of the required casting.

Large sleeves, cylinders, cylinder liners, paper mill shells and many other castings in that general group are poured through a ring of pop gates around the top edge. This method also is employed on cast iron pipe cast in a vertical position.

(*To be continued*)

Editor's Note: The foregoing articles are based on chapters from "Elementary Foundry Technology," by Lawrence A. Hartley, published by the Penton Publishing Co., 1941, and rewritten by the authors indicated.



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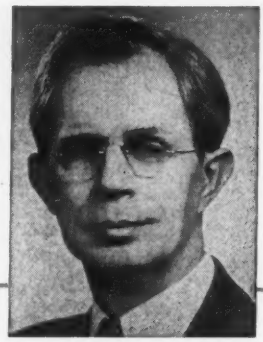
MAN-TO-MAN

on the Molder's Bench

By RALPH L. LEE



"Graduation"

IF THE situations which created foundries, and the incidents which struck fire to spark foundry careers, were gone over with a fine-tooth comb, I doubt very much whether we'd find many examples in which the old wagon was hitched to a star, or where an all-consuming passion for a life of service to mankind—including purchasing agents—turned out to be responsible.

More than likely, happenstances met and mated up with the need for earning the old bread and butter—and the outcome was foundries and foundrymen. This doesn't mean, of course, that once the flame was sparked there wasn't a lot of sincere and energetic flame fanning and fire tending.

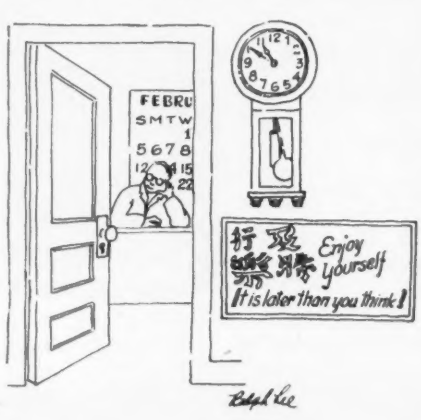
What I'm groping around to get at is—the chances are that many foundrymen woke up one day to find themselves pretty well geared into the foundry business without too clear a picture of the life job they had cut out for themselves or any set schedule for getting it done. So with only the vaguest kind of a plan and schedule to meet, there is little wonder that fully ripened foundrymen who approach the age where much more fishing is in order, should be pretty much in a fog as to just how much more work they had to get done before they could tend to the fishing. As I go about the country visiting foundries I meet senior foundrymen in all degrees of haziness about the status of their life work program and fishing.

Some, without ever realizing what they have done, seem to have spent their lives building a little foundry kingdom, with subjects but without heirs to succeed them. Their reign is all they have lived for; they just can't imagine anything else and consequently they have no plans to abdicate.

Some have been so thoroughly swamped all their lives trying to do the job themselves, they have never had time to come up for air to see where they are. They can't remember the beginning and they can't imagine the finish. Others know nothing else than the feeling of being driven, hounded, haunted and pestered. They are afraid to stop and think of what would happen to the outfit, themselves and their dependents if something should happen to them.

Then, thank the Lord, I also find those oldsters who have never taken themselves too seriously, with little loss of sleep as to just where they stand in relation to others both as to rank and class; but with a slight touch of intelligent laziness they have managed to avoid doing anything they can get someone else to do. For the sake of the industry I like to think that this breed of cats is in the majority.

Without trying to be the least bit



noble, these foundry-folk have always been on the lookout for and cabbaged onto every green shoot of talent they could find. Then they fertilized the ground, weeded the garden, debugged and watered the plants. Now they kindo' rub their hands together as they view the ripening crop on the way to their bulging barn where the fishing pole is kept.

The reason I'm almost waxing eloquent is that, according to the calendar, I find myself in one of these classifications. So I'm trying to get my house in order, so I can answer the call of the wild—that is, the wild of the Lee Hobby Foundry.

As I go about this job I come to the conclusion that after a fellow has learned his trade, so to speak, worked at it to a point where he has definitely found his niche or, much more likely, his niche has found him, then there comes a time when he has every right—in fact, a duty—to accept that niche as a fact and to graduate with suitable commencement exercises. (Fishing is good exercise.)

The way I figure it, the job of amounting to something should by now be pretty well over the dam. The job of proving himself to himself and the rest of the world, should now, by what he has done, be past history. With the kids on their own and away from home, and with the style of living that has made it home now leveled off to where it should be and likely to stay, folks like us have every right to look forward to the bank balance of years in old Father Time's ledger as the time for which we were born.

I am positive this heyday has little connection with the bank balance; in fact, I wouldn't trade places with a lot of well heeled folks who could buy and sell me a dozen times, while I'd gladly step into the shoes of others who have never earned nor have nearly as much as I.

Cashing in on the grand days to come rests squarely on a viewpoint, and this viewpoint rests squarely on the foundation of mastering the technique from here on out of *living (willingly and enthusiastically) within our means, of time, strength, talent, experience, conditions* and last and least *money.*

With the decks cleared of most of the musts and the umbilical cord which may have made us hold on to pride, place, institutions and people finally cut, we should now be able to speak our piece without fear or favor. We should now be able to experiment a bit without plunging and, with the time left over from fishing, dig into those things we've never had

(*Concluded on page* 131)

NEW No. 3 SIMPSON MIXER

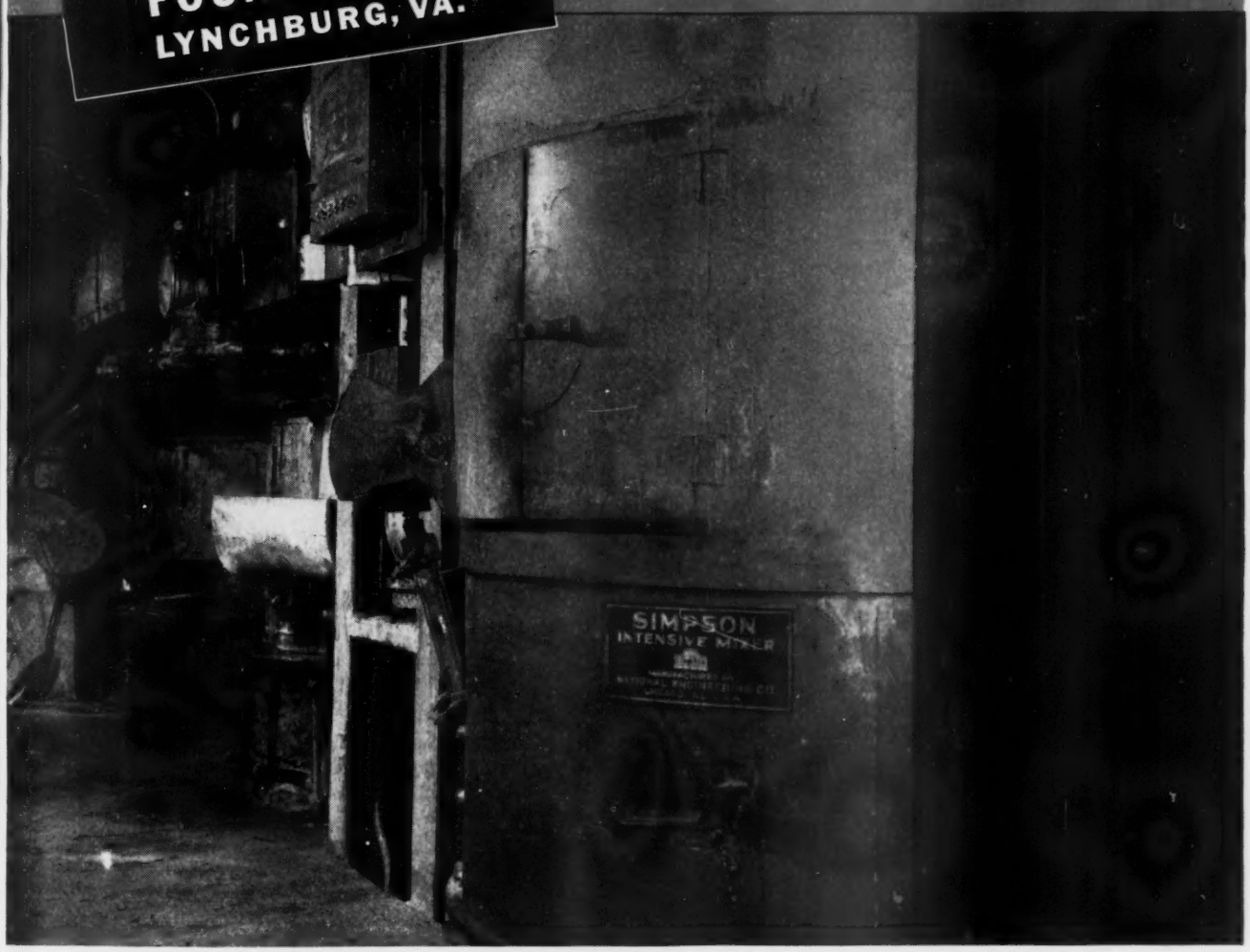
Doubles Capacity

OF SAND PREPARING PLANT at LYNCHBURG FOUNDRY CO.

LYNCHBURG, VA.

IMPROVED SURFACE FINISH AND MARKED REDUCTION IN SCRAP LOSS RESULTED WHEN A NO. 3 SIMPSON MIXER WAS RECENTLY INSTALLED TO AUGMENT CAPACITY OF EXISTING UNIT.

TO FIT INTO LAYOUT TO BEST ADVANTAGE, THE SINGLE LARGE DISCHARGE DOOR ARRANGEMENT WAS USED. THE 50 CUBIC FOOT BATCH OF SAND WEIGHING SOME 3300 LBS. IS DISCHARGED IN 13 SECONDS.



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SOFFEL'S
New THERMOTOMIC-X
(PATENTED)

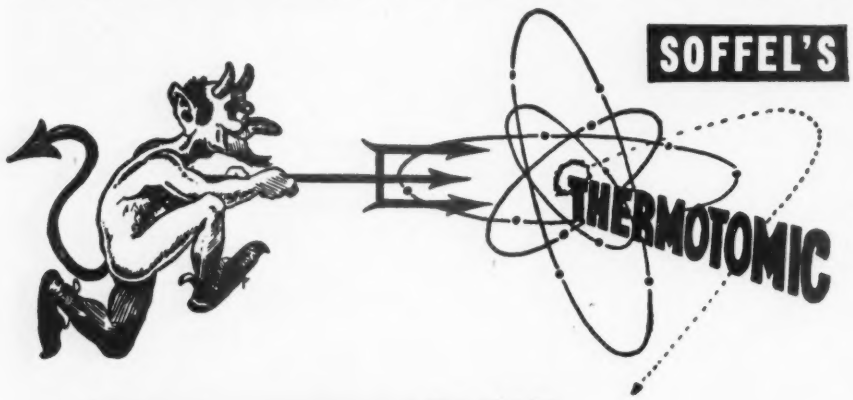
exothermic metal feeding compound

√ Cuts Casting Costs

√ Makes Better Castings

FOR STEEL, STAINLESS STEEL, GRAY OR MALLEABLE IRONS, COPPER, BRASS, BRONZE AND ALUMINUM

A new, improved, hotter and faster acting THERMOTOMIC X will increase temperatures and fluidity in the risers without bubbling and boiling. A means of introducing heat energy into the feeding metal in the heads or risers of castings or at other localized points in the mold by the use of inserts or as a facing. Increased yield by the reduction of heads, control of directional feeding and the elimination of scrap due to piping, porosity and shrinkage are the results to be obtained by the use of this patented compound. Thermotomic ABC and AL-X31 Liquidizer are recommended for aluminum.



Reduces Size of Risers and Feeder Heads

Heads and Risers Removed without Cutting and Burning

Increases Yield

Eliminates Shrinkage and Piping in Castings

WHAT IS THERMOTOMIC?

Thermotomic Compound is an exothermic material which can be molded and baked into any desired shapes just as sand cores are made. It produces a temperature of 3500° F. It is used as ring inserts under the risers or feeding heads, or as facing inserts where it is desirable to maintain the fluidity of the metal in the mold at those points where rapid cooling may cause piping, shrinkage or segregation. Great savings are realized through reduced riser dimensions and cleaning costs. For use in green sand molds, use Thermotomic WP (waterproofed). Soffel's Carbon-Free Liquidizer No. 5 is recommended for use with Thermotomic feeding compounds on top of the feeding heads.

EXOTHERMIC CARBON FREE LIQUIDIZER

SOFFEL'S EXOTHERMIC CARBON FREE LIQUIDIZER is the leader in major foundries for use on ferrous and nonferrous metals, and in ingot production. It is the first and the original scientific non-carbon exothermic compound for feeding heads and risers.

SOFFEL'S EXOTHERMIC CARBON FREE LIQUIDIZER is different from ordinary head compounds in two ways: It is CARBON FREE, thereby eliminating carbon pick-up. It is EXOTHERMIC. Carbonaceous materials, regardless of their composition, will cause carbon pick-up, segregation, non-uniform grain structure and hard spots under risers and in castings. Carbonaceous materials contribute no added heat value or increased temperatures to the feeding metal and only act as an insulating cover.

SOFFEL'S EXOTHERMIC CARBON FREE LIQUIDIZER reacts within itself exothermically, producing a temperature above 3200° F. actually increasing the temperature of the feeding metal to a point well above that of the metal in the main body of the casting, thus ensuring that the feeding metal will be the last to freeze. Shrink cavities in the casting caused by premature freezing of the feeding metal are eliminated. After the exothermic action has ceased, the LIQUIDIZER forms a soft insulating blanket on the metal. This confines the heat generated by the LIQUIDIZER and aids in maintaining the desired high temperature of the feeding metal in the heads.

THERMOTOMIC HOTOP CARBON FREE LIQUIDIZER

SOFFEL'S THERMOTOMIC HOTOP CARBON FREE LIQUIDIZER is for castings of iron and steel. A new exothermic compound which produces over 4000° F. of heat. It is used for dissolving and reducing skulls in ladles of iron and steel and on the feeding heads and risers of castings and also for ingot hot-topping. SOFFEL'S THERMOTOMIC HOTOP will permit reducing feeding heads from 60 to 70% or the height as low as one-half the size of the diameter.

For ladle use when SOFFEL'S THERMOTOMIC HOTOP is applied to cold, sluggish metal of iron or steel on the surface of the metal, the exothermic action of THERMOTOMIC HOTOP increases the temperature several hundred degrees and adds fluidity. It will save much metal which would have been discarded as scrap. THERMOTOMIC HOTOP is guaranteed not to change the chemical analysis of iron or steel, as it is carbon free and is recommended only for ferrous use.

"Beware of Imitations"

Pittsburgh Metals Purifying Co.

Manufacturers of Quality Fluxes and Purifiers for All Metals and Alloys

1352 Marvista St. N. S. **Pittsburgh 12, Pa.**

(*Concluded from page* 128)

time to get at. And to top it off, what greater adventure could there be than to pull down off our shelves of experience volumes of information for the youngsters coming along, for helping the craft and, yes, the society of both young and old.

A brilliant Chinese student in one of our top-notch universities was asked what he intended to become with all of his excellent learning. "I want to follow in the footsteps of my honored father," he replied. "What is he?" came next. "My father is a student. After raising his family and providing for their education he retired to learn the wisdom of the ancients, that of his contemporaries and of the marvels of nature all about him. His chosen profession was that of a student with money-making only a means to that end."

With our senior foundrymen barely having caught their breath from their World War II stint and the defense program now on top of us, we'd better begin loading up the young blood or there won't be any graduation, heyday or fishing.

Book Review

Modern Refractory Practice, cloth; 440 pages 8 x 11 in. Compiled and issued by the Harbison-Walker Refractories Co., Farmers Bank Building, Pittsburgh 22.

This third and greatly enlarged edition of a highly popular work is claimed to be the most complete and useful book ever published on industrial refractories and their applications. The publication is a practical engineering handbook, a comprehensive technical treatise, and a catalog of the company's products, combined in a single volume. While it follows the general lines of the second edition published in 1937, the book has been completely rewritten and increased in size from 296 to 440 pages.

Scale drawings of twenty types of furnaces, illustrating up-to-date industrial practice, constitute one of the most important features. The drawings show in detail not only the design of the furnaces, but also the types of refractories generally used and, in some cases, alternate types for special operating conditions. Discussion of service conditions and refractory requirements in furnaces of wide variety should prove helpful to furnace operators.

A chapter is devoted to practical suggestions regarding selection, care and use of refractories. Another chapter discusses arch construction and design, placement of skewbacks, calculation of arch stresses, and design of arches of high rise. The chapter on the properties of refractories is in two parts. The first is devoted largely to mineralogy of refractories, and to stability relations at high temperatures. The second part pertains to the chemical and physical properties. This chapter contains considerable material not previously published and will serve to excellent advantage as a text.

The book is offered without charge to refractory users, libraries, and to heads of departments in universities and technical schools. For general distribution or for student use a charge is made, much lower than the cost of preparation.

Civil Defense Discussed

A booklet, "United States Civil Defense," has been published by the National Security Resources Board and is available through the Superintendent of Documents, Washington 25, for 25 cents. The publication deals with policy and responsibility in and the general features of training for civilian defense, the details to be followed in connection with air raid protection and the steps to be taken following an attack. Part III deals with initial steps in civilian defense planning and a hypothetical attack narrative on a particular point. The appendix includes suggested state and local organization charts.

EXPANDING MAGNESIUM DEMAND

Predicted at Association Meeting

CONTINUED expansion in consumption and production of all forms of magnesium is in prospect for coming months, it was stated at the sixth annual meeting of the Magnesium Association held at the Biltmore Hotel, New York, Nov. 9-10. Military and civilian demands recently have been 25 per cent in excess of supply, but coming reactivation of six government-owned standby plants will increase production capacity of the primary metal from 48 million pounds annually to 240 million pounds.

At the annual business meeting of the association, A. W. Winston, Dow Chemical Co., Midland, Mich., was re-elected president. W. C. Murray, Utica Radiator Corp., Utica, N. Y., was named vice president, and Otis E. Grant, Superior Bearing Bronze Co., Brooklyn, N. Y., treasurer. Martha I. Hansen continues as assistant secretary at association headquarters, 122 East 42nd St., New York. The Castings Division of the association chose A. J. Marotta, Utica Radiator Corp., as chairman for the coming year.

Three technical sessions were held during the meeting, the first being devoted to castings and the other two to wrought products. M. E. Brooks, Dow Chemical Co., presided at the castings session at which two talks were given on magnesium alloys and two on practical aspects of magnesium casting practice. H. E. Elliott, Dow Chemical Co., discussed properties and applications of the magnesium rare earth and zirconium alloys. Kurt S. Sealander, Aluminum Co. of America, Buffalo, offered recommendations for the preparation of magnesium metal, its melting and fluxing.

Don Smith, Wellman Bronze & Aluminum Co., Cleveland, described molding and coremaking practice in the magnesium foundry. C. E. Nelson, Dow Chemical Co., discussed a relatively new magnesium alloy, Dowmetal AZ91. Aluminum composition of this alloy is between the 8.5 per cent of Dowmetal A and the 10 per cent of Dowmetal G, with zinc added (0.4-1.0 per cent) to increase corrosion resistance and increase strength.

Strictly commercial uses of magnesium have increased steadily since the war, it was pointed out by Edward S. Christiansen, president, Magnesium Co. of America, and past president of the Magnesium Association. Totals were 29.9 million pounds in 1946, 30.2 million in 1947, 31.3 million in 1948, 38 million in 1949, 43 million in 1950. He predicted use of 75 million in 1951 and 102 million in 1952. Moreover, he added, this generation should see annual production approaching 1 billion pounds.

Currently, castings account for 28 per cent of total magnesium consumption. Of the 200 companies now in the magnesium business six are primary metal producers, three secondary metal smelters, three each in sheet and forging manufacture, four extrusion mills and over 65 sand, permanent mold and die casting plants. The remainder are magnesium fabricators. Speaking of metallurgical uses, Mr. Christiansen said it is estimated that 5 to 10 million pounds of magnesium will be absorbed annually in production of nodular graphite cast iron.

AROUND THE COUNTRY

CHICAGO—A new foundry enterprise in Chicago is extremely unique. It is the J. A. Aluminum Co. (tradename JALCO) recently organized under the Junior Achievement program by 16 Tilden Technical High School boys, ages 15 to 18, to make and sell cast aluminum products. For its production, the company will use the foundry facilities available at the Museum of Science and Industry.

Junior Achievement enterprises are widely known and varying in nature, but this is said to be the first time that one of them has engaged in so-called "heavy industry" work.

Present products of JALCO include ash trays, house numbers, muddlers, and the like, and the plan is to introduce new ones from time to time. The Museum foundry facilities are being used on a rental basis. Capitalization of the company is $500, consisting of 1000 shares of 50-cent par value stock of which 778 shares have been issued.

Officers of the company are: Thomas Rozanas, president; Raymond Hayden, vice president; Robert Cummings, treasurer; and Richard Forey, secretary. Edward Ladewski is sales manager and Robert Botwinski, production manager. All officers and stockholders have studied or currently are enrolled in the foundry courses at Tilden Tech.

Overall supervision of the company is under direction of a seven-man advisory group from the executive office and factory staff of Crane Co., an appropriate sponsorship since this company has extensive foundry operations. H. V. Jones, auditor, is chief advisor. Other members of the advisory group are: P. R. Rasmussen, tax accountant; W. J. Clark Jr., foundry superintendent; John Juraska, foundry foreman; C. G. Quist, foundry foreman; Ray A. Pape, assistant manager of plumbing sales, and C. F. Wilson, sales training.

Through their experience in operating the company and contacts with the advisory group, the boys are learning first hand the significance of the free enterprise system and the profit motive as an integral part of the system.

* * *

In this department two months ago it was revealed that Ford Motor Co. was taking over the former World War II Dodge-Chicago plant and reactivating it to manufacture 28-cylinder, Pratt & Whitney Wasp Major engines for the Air Force. According to James Knowles, chief product engineer of the new Ford Aircraft Engine Division, this engine is "possibly the largest reciprocating engine in the world" and there is reason to believe that no other country has had access to sufficient technical data to duplicate this new-type B-36 engine, which contains several hundred more parts than its World War II predecessor.

"It is the opinion of many engineers," he states, "that any other country would take at least three years to duplicate this engine. Mr. Knowles says the engine assembly is approximately 5 ft in diameter and 10 ft long, that the horsepower is somewhere near 4000 with a 4360 cu. in. piston displacement. Magnesium and aluminum castings and forgings are used extensively. One magnesium casting, while in the 'as cast' state, weighs about 125 pounds. Those acquainted with magnesium will recognize this as a fair-sized casting," Mr. Knowles asserts.

* * *

Philadelphia — Shortage of skilled help is now the major operating bottleneck at ferrous foundries in this district; nonferrous foundries are similarly affected, although scarcity of metals, particularly aluminum, is said to be of even greater importance at various shops. In all categories there is sufficient business to warrant higher operations.

Gray iron producers generally are operating five days a week and in a few isolated cases Saturday as well. The average jobbing foundry has an order backlog of six to eight weeks. Pipe shops and large captive shops have backlogs extending several months in some instances.

District steel foundries are virtually snowed under with work, reflecting particularly fast expanding demands from railroads and railroad equipment manufacturers. These foundries have backlogs of 15 to 16 weeks on an average. However, due to shortage of skilled help (common labor still seems fairly plentiful), most are operating only five days a week, some pouring on Saturday.

Scarcity of aluminum is resulting in the diversion of more work to the iron foundries. Some aluminum die-casting business, for instance, is being diverted to sand cast iron and some to permanent molding. The latter trend is slower, however, because of expensive tooling often necessary and because application is limited principally to large quantity production.

Castings prices generally are increasing due to higher labor and material costs. Recent wage advances at district foundries having AFL contracts were about 10 cents an hour.

(*Concluded on page* 134)

Air Grinder Is Adapted to Pipe Cutting

CONVERSION of an air grinder to cutting centrifugally cast iron pipe by a Muskegon, Mich., contracting firm is said to have reduced cutting time by 90 per cent over previously used methods. The contractors mounted a grinder motor, manufactured by Independent Pneumatic Tool Co., Aurora, Ill., on a metal base equipped with rollers and attached an abrasive disk. Taking a 5/8-in. cut, the converted pneumatically operated grinder does a clean, neat, job, producing eight cuts every 9 hr on 30-in. pipe.

START THE NEW YEAR RIGHT

First, let's nail down these two facts about

KORWELD

the new FMC core paste development:

Foundry users claim that it is 80% STRONGER

Develops 1/2 to 2/3 LESS GAS than any thing they've ever used

KORWELD is really a good product. It is not just another core paste; it is an all-purpose core paste that was slowly and deliberately developed over a period of time to meet the following conditions:

WELDING—Because it penetrates deep into the core and around the sand particles, it grips with greater strength into the actual grain structure, creating a deep rather than a surface weld.

DRYING—Ordinary core paste will dry rapidly and have a high tensile strength, but KORWELD dries *faster* and gives a *higher* tensile strength. This is a special advantage in production work.

RESISTANCE TO MOISTURE—The special blending of KORWELD increases its resistance to moisture. Because of this property, cores pasted with KORWELD may be stored longer, and they stand up better in damp molds.

GAS—Foundry users claim that KORWELD develops ½ to 2/3 less gas than anything they've ever used. For this reason, KORWELD is often used as a daub.

These properties in a core paste are too important to overlook. The claims we make for KORWELD —claims that are backed up by satisfied users—will mean more profits for you. As a cautious business man, you should investigate first—so why not fill in the coupon today?

OTHER FMC FOUNDRY PRODUCTS FOR IMMEDIATE SHIPMENT:

AKRO COMPOUND
BENTONITE (National)
BLAST SAND
BOTTOM BOARDS
FMC (Aluminum)
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CORE BLOWERS (Champion)
CORE OVENS (Despatch)
CORE PLATES
FMC (Aluminum)
CORE WIRE
FIRE BRICK (Durex)
FLUX (Sultron)
FIRE CLAY (Cedar Heights)
FIRESTONE (Scioto)
MILL STARS
MOULDING SANDS (44 grades)
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Coldwater, Michigan *(Subject: Korweld Core Paste Development)*

Please send us: ☐ Literature ☐ Price Information ☐ Case Histories

Name ..... **Company** .....

Address .....

(*Concluded from page* 132)

effective Nov. 15. This applied to both ferrous and nonferrous shops. At time this report went to press various shops having CIO contracts were in the process of working out new wage schedules.

Until recently prices on nonferrous castings have shown greater buoyancy than ferrous grades due to the sharp increases in metal prices. Ferrous raw materials, however, are now advancing more sharply, including the recent increase of $3 in domestic pig iron and substantial advances in scrap and ferro alloys. Foreign pig iron prices have jumped to around $65 to $70, duty paid, delivered Philadelphia. Most of the larger shops have been augmenting their domestic supply with foreign iron. There is an increasing scarcity of foreign iron, and some look for a complete drying up of imports by the middle of next year.

One encouraging note is probability that the Chester, Pa., furnace, a subsidiary of Central Iron & Steel Co., Harrisburg, Pa., will get into operation not later than February. No little of this iron will undoubtedly go to Central and also to Phoenix Iron & Steel Co., Phoenixville, Pa., an associated company; nevertheless, it should relieve the pressure for iron in the district, especially once operations reach the daily capacity of 500 tons.

District foundry operations in December were off a bit due to year-end influences. So far there has been little direct defense work to bolster production, but this may come in much heavier volume in 1951.

* * *

Pittsburgh—A mixed trend in order volume is evident among district foundries. Credit restrictions and material shortages already are curtailing new bookings among foundries serving the plumbing and heating industry. A 25 to 30 per cent drop in orders is reported by one concern.

Indicative of the high level of activity in the housing industry last year, American Radiator & Standard Sanitary Corp. reports net sales for 1950 exceeded record 1948 total of $236 million. About 1.3 million new homes were started last year, a new high. However, current estimates of new homes to be started this year range from 500,000 to 800,000 units.

Foundries serving the electrical appliance trade similarly have experienced a drop in new orders, because of the scarcity of materials and credit restrictions on end product sales.

In contrast with this trend in consumer goods, there is no letup in expanding order backlogs among foundries supplying the railroads, machine tool, electrical equipment and heavy machinery groups. Nonferrous foundries continue to experience a steady increase in demand but shortages of copper, nickel, tin, etc., have prevented corresponding upturn in output. A growing volume of orders related directly to military procurement programs also is noted.

Jobbing shops are operating at six days a week where raw materials and manpower will permit. In a few instances the overtime pay involved does not warrant extending schedules to 6 days. Consideration again is being given to raising prices by jobbing shops. Since the last advance of 10 to 15 per cent early in September, wages were increased 7½ per cent around mid-October, while over foundry coke is up $2, pig iron has advanced $3 and cast scrap $5 to $8 per ton. There also is possibility employees will ask for another general wage increase in anticipation of a "freeze" on wages as well as prices.

Meetings of Interest to Foundrymen

Jan. 15-18—Plant Maintenance Conference and Show, Public Auditorium, Cleveland

Jan. 19—Malleable Founders' Society, semi-annual meeting, Hotel Cleveland, Cleveland

Jan. 22-26—American Society of Heating & Ventilating Engineers, exposition and annual meeting, Commercial Museum, Philadelphia

Feb. 8-9—Wisconsin Regional Foundry Conference, sponsored by Wisconsin Chapter of AFS and University of Wisconsin, Schroeder Hotel, Milwaukee

Feb. 22-23—Birmingham Regional Foundry Conference, Birmingham District Chapter and University of Alabama Student Chapter of the AFS, Tutwiler Hotel, Birmingham

Feb. 23—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Mar. 2—Malleable Founders' Society, eastern sectional meeting, Hotel Commodore, New York

Mar. 5-9—American Society for Testing Materials, committee week, Netherland Plaza Hotel, Cincinnati

Mar. 9-10—Ohio Regional Foundry Conference, sponsored by Ohio Chapters and Ohio State University Student Chapter of AFS, Case Institute of Technology, Cleveland

Mar. 19-23—Western Metal Congress & Exposition, Civic Auditorium, Oakland, Calif.

Mar. 23—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Apr. 23-26—American Foundrymen's Society, annual convention, Buffalo

Apr. 27—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Apr. 30-May 4—Material Handling Institute and American Material Handling Society, exposition and conference, International Amphitheatre, Chicago

May 18—Malleable Founders' Society, eastern sectional meeting, Hotel Commodore, New York

May 23-24—American Society for Quality Control, annual convention, Hotel Cleveland, Cleveland

May 25—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

June 4-6—French Foundry Association, foundry congress, Paris, France

June 12-15—Institute of British Foundrymen, foundry congress, Newcastle-on-Tyne, England

June 18-22—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hotel, Atlantic City, N. J.

June 21-22—Malleable Founders' Society, annual meeting, the Homestead, Hot Springs, Va.

July 27—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Sept. 10-14—International Foundry Congress, Brussels, Belgium

Oct. 15-19—American Society for Metals, annual meeting and exhibit, Detroit

Oct. 25-26—Gray Iron Founders' Society, annual meeting, Edgewater Beach Hotel, Chicago

Oct. 31-Nov. 2—Foundry Equipment Manufacturers' Association, annual meeting. The Homestead, Hot Springs, Va.

Nov. 7-9—Meehanite Casting Manufacturers, annual meeting, the New Yorker, New York

Nov. 15-16 — National Foundry Association, annual meeting, Waldorf-Astoria Hotel, New York

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SUPPORT RODS WELDED TO MOTOR BASE
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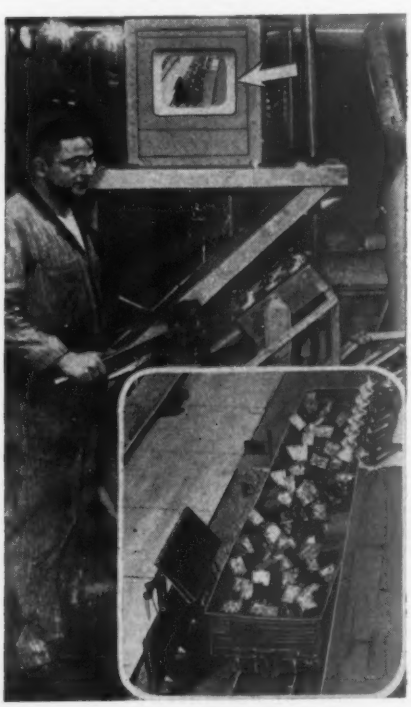
By EDWIN BREMER

Foundry DEVELOPMENTS

INVESTIGATION of the physics of molten-metal penetration into sand molds by Dr. T. P. Hoar and D. V. Atterton included the application of lime-silica-fayalite washes to the mold face, with interesting results. No metal penetration occurred, and the metal peeled cleanly from the interface. The lime-silica-fayalite wash acts quite differently from the usual silica wash since it forms a slag which penetrates the mold face and provides a continuous, nonporous surface. It was indicated that further study of such mold washes will be made.

* * *

OPPORTUNITIES which exist for expansion of television into the industrial field is shown in the accompanying illustration taken at the new Fisher Body Pittsburgh plant. Television camera mounted on a beam extending from the building roof is focused on the discharge end of the baled scrap conveyor. Television screen or receiving unit is mounted in the interior of the building where the operator of the scrap baler can view it. Picture of the car loading operation is constantly reflected on the monitor screen, allowing the baler operator to see when the car needs to be moved to fill it uniformly. Movement of the car is controlled from the baler station. A similar installation might be used in the foundry for watching the charging of the cupola, or following operations at a distant point, observing the progress of an electric furnace or open-hearth heat, etc.



* * *

EXPERIENCE with a specific composition for cylinder blocks and heads indicated that if the alloying agents —nickel, chromium and molybdenum —exceeded about 0.3 per cent each, trouble was encountered with porosity. Other elements of the iron showed 3.25 per cent TC, 2 per cent Si, 0.7 per cent Mn, 0.12 to 0.15 per cent P, and 0.10 to 0.12 per cent S.

* * *

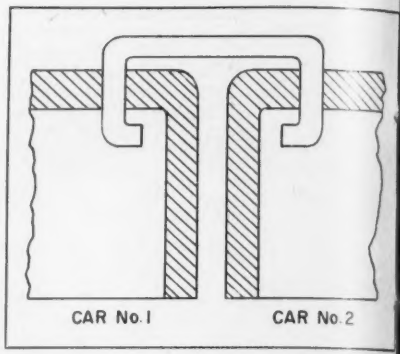
RECENTLY granted patent describes an aluminum-base alloy which is characterized by excellent casting properties, corrosion resistance, and freedom from shrinkage cracks and pitting in the cast condition. Patent is No. 2,526,227, and the composition of the alloy is given as containing 1.75 to 2.25 per cent Si, 0.3 to 0.75 per cent Zn, 2.75 to 3.25 per cent Mg, 0.08 to 0.2 per cent Ti, 0.1 to 0.2 per cent Cr, and remainder Al.

* * *

STUDY of magnesium and cerium treated irons which were poured into graphite molds to obtain a white structure material, and subsequently heat treated to obtain graphite precipitation, is reported by J. W. Grant in the October, 1950 issue of *Journal of Research and Development,* British Cast Iron Research Association. In the normal ranges of cerium the graphite deposited in "aggregate" form while with magnesium the graphite was spherulitic. With high cerium content, spherulitic graphite occurred, but with low magnesium content, "aggregate" graphite was deposited.

* * *

OVEN CAR clamps or couplings in Allis-Chalmers No. 1 foundry have been redesigned to prevent slipping as the result of a suggestion by Alfred Schramm, a blacksmith. Clamps previously used had a straight shank and occasionally slipped off when the cars were being pulled out of the ovens by a pulley and chain drawn by a crane. This often caused delays up to one hour before the cars were drawn back together and reclamped. New clamps have a toed shank as shown in the accompanying illustration.



Projections at ends of coupling shank prevent it from slipping out from the cars

* * *

TYPE OF ingate for feeding certain gray iron castings, said to give excellent results in Great Britain, is attached to the casting by a 1/16-in. wide slot. Known variously as the "Connor," lip or block runner or feeder, it was originated by F. J. Connor, J & E. Hall Ltd. In the method a sizable cubical block or riser into which the sprue is gated is used, and the block is attached to the casting at the top by an overlap of 1/16-in. For example, on a casting 11½ in. in diam, 5-in. high and weighing 135 lb, the block was 4 x 5¼ x 5¾ in. and attached to the casting with a 1/16 x 4-in. ingate. In case of two castings weighing 15 lb each, attached to a single block, the block was 2⅞ x 3¼ x 3⅛ in., and the ingates were 1/16 x 2⅞ in.

* * *

IN ONE foundry producing cast steel crankshafts for automotive use in core molds, the cores are coated with a silica wash. At first the coating was applied by spraying, but it was found that too often small areas were missed or the coating was too thin in spots, necessitating a return for recoating. As a result the method was changed to dipping.

Logan Conveyors provide a "moving floor" for pouring operations in steel foundry. Lines are fed from molding machines in rear of picture. Roller conveyor transfer car handles the cooled molds to additional storage lines serving shakeout.

War work *or* Peace work?

Whichever you do, the problem is the same — *greater productivity.*

This problem is being solved in many instances by conveyors to (a) keep molding and machining equipment operating at capacity (b) deliver molds and castings to operators at convenient working height (c) save time and effort between processes.

Logan Conveyors assure maximum returns in each instance, due to Logan planning and engineering. Experience counts. Two generations of it are behind every section of Logan equipment.

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HOW TO USE THE CUPOLA

By BERNARD P. MULCAHY
President
Fuel Research Laboratory Inc.
Indianapolis

IN the production of iron the cupola today is used exclusively to remelt and recover scrap iron in the form of gray iron, malleable iron and steel. The mix is adjusted to the desired composition by additions of pig iron and alloys.

Cupolas are operated in all 48 states, producing iron commercially in carbon content ranging from 2.40 to 3.80 per cent and with melting rates ranging from 1 to 30 tons per hour.

Length of heats generally vary from 1 to 18 hours (in special instances with water-cooled shell up to 48-72 hours).

Diameters of commercial cupolas vary from 18 to 84 in.

Weight of charges varies from 200 to 10,000 lb.

All cupolas use coke as the principal fuel. Coke for cupolas originates from coal from four regions—Appalachian, Southern, Midcontinent and Western, the latter two producing only very small amounts.

The cupola is a vertical steel shaft lined with refractory, equipped with air ports at the bottom and a charging hole in the upper section for introducing the raw materials. Below the air ports or tuyeres is a section called the well, from the bottom of which through the tap hole the molten metal is withdrawn, while from the top of the well and just below the tuyeres the slag is removed. In front slagging the metal and slag discharge through a single hole, to a small well in the runner where the slag is dammed off for removal.

Initially heat for the process is supplied by a bed of coke, on top of which are placed alternate layers of iron and coke. Air (from a blower) introduced through the tuyeres, burns the coke and the hot gases ascend through the upper charges of metal. Coke in the bed is consumed, and the heat released melts the metal. When this is accomplished fresh coke between the metal charges reaches the bed and the process continues. The process is one of counter-current flow, the heat and gases rising upward and out the top of the stack, while the metal descends and is withdrawn from the bottom of the well.

The process is the most thermally efficient used in the metal industry because of this counter current flow and additionally because the materials are always in intimate contact with each other.

The simplicity of the process is the reason both for its success and for the many difficulties encountered. This will be clearly shown as the details of operation are developed.

The process, of course, is subject to many variables which are inherent, and to many variations which are within the control of the operator. Both add to the confusion which frequently exists over proper operation.

The chemistry of the process is as complex as the mechanics are simple, due to the variables and the variations just mentioned. For this reason it is necessary to dissect the entire process and discover the scope and limitations of all of the factors involved. In doing so we will automatically determine the reasons for many of the common difficulties encountered.

Cupola dimensions and corresponding melting rates are shown in the accompanying table. Note that melting rate is a direct function of cupola diameter.

MELTING CAPACITIES OF CUPOLAS

Diam.,* in.	Area, sq in.	Lb/hr at 10 lb/sq in./hr	Tons per hr
36	1018	10,180	5.1
48	1810	18,100	9.0
60	2827	28,270	14.1
72	4072	40,720	20.3

* Diameter measured in working area.

These melting rates are generally increased by increasing air rate or decreasing coke, and decreased by decreasing air rate or increasing coke.

When conditions are properly balanced, the melting rate can be varied from the figures shown in the table by approximately ± 15 per cent. It must be kept in mind, however, that higher-than-normal melting rates will drive the process toward a higher state of oxidation while a lower-than-normal rate will drive the process to the reduced state.

Editor's Note: This is the first of a series of articles discussing the basic factors involved in operating the cupola. The author, an authority on fuels and cupola melting practice, is a member of FOUNDRY's advisory staff.

Height—The operating height is the distance from the tuyeres to the charging door, or the top level of the last charge. Actual operating heights range from 8 to 30 ft. Suggested optimum height for all cupolas is 16 to 22 ft; reason for this is that with less than 16 ft the stock is subjected to insufficient preheat, and the process becomes thermally inefficient.

A stock height above 22 ft has not shown an increase in thermal efficiency and can be a serious deterrent when corrections or changes in the mix are desirable. The time involved is too long to correct quickly because of the greater number of charges involved.

Additionally, the density of the stock column or total back pressure is increased with a high stack, which may be of serious concern in connection with blower capacity.

Tuyeres—The area of a tuyere is the cross-sectional area of the smallest open face. For example, a conventional box tuyere having dimensions at the wind box side of 6 in. high x 14 in. wide would have an area of 84 sq. in. If eight tuyeres of this size were installed in a 60-in. diameter cupola the tuyere-cupola ratio would be:

$$\frac{(6 \times 14) \times 8}{\pi\,(30)^2\ \text{(approx.)}} = \frac{672}{2826} = 24\%$$

The different kinds of tuyeres are:

Box—Individual boxes leading directly into the tuyere opening. The boxes are connected to the wind box on the lower side. This is the newer form.

Old—The air flows directly from the wind box through an opening on the shell side into the tuyere.

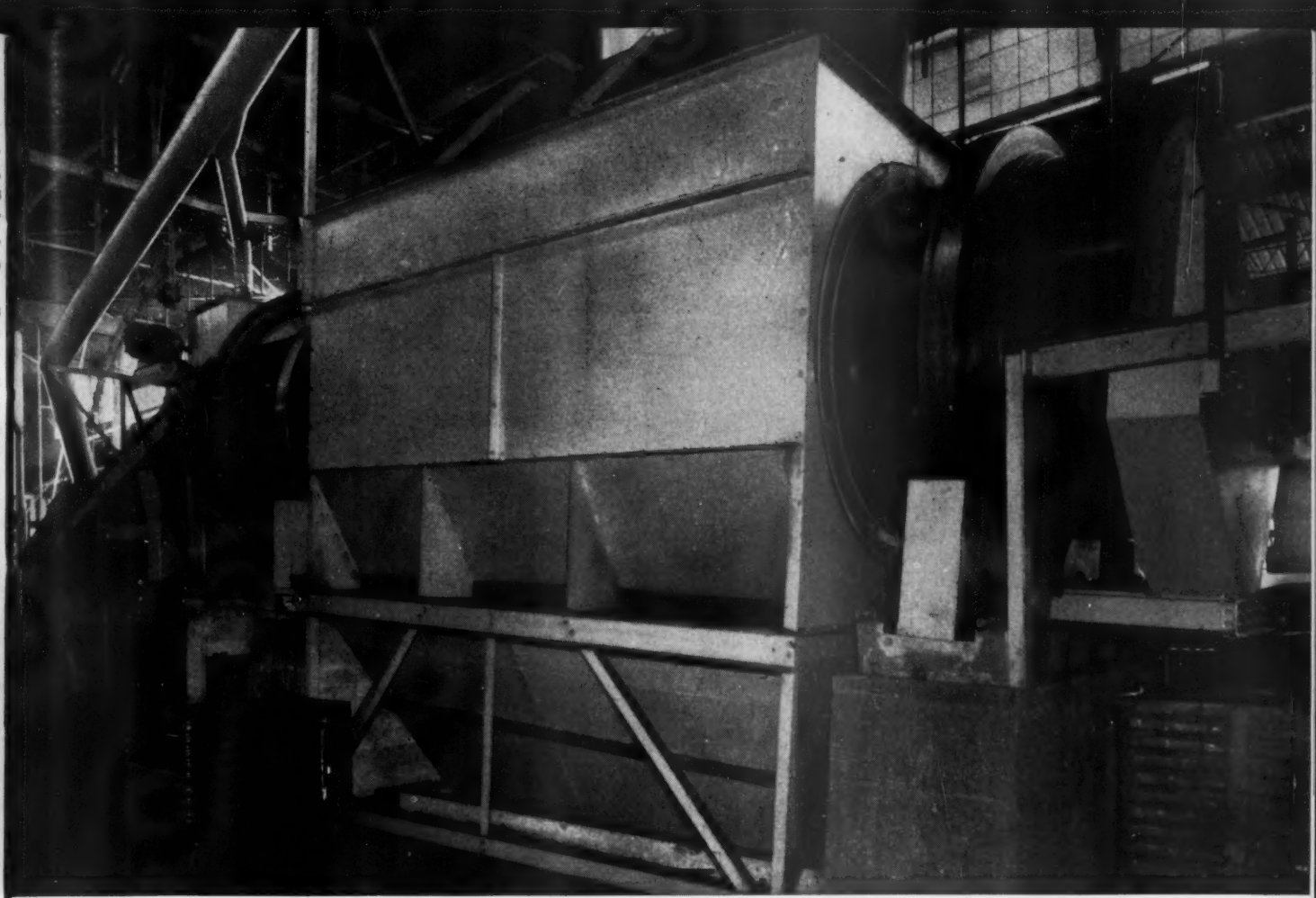
Continuous—The air flows directly from the wind box through spacers evenly divided around the whole circumference.

Circular—As in the balanced blast, circular pipes are evenly spaced around the circumference—connected directly or indirectly to the wind box.

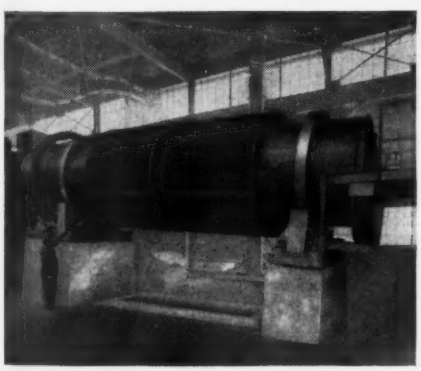
Two or More Rows—In addition to regular tuyeres sometimes a second row is installed 12 to 18 in. above the regular row. They are generally smaller in size and located midway between regular tuyeres. Balanced blast contains three rows.

Some cupolas are equipped with valves (balanced blast) in the lower

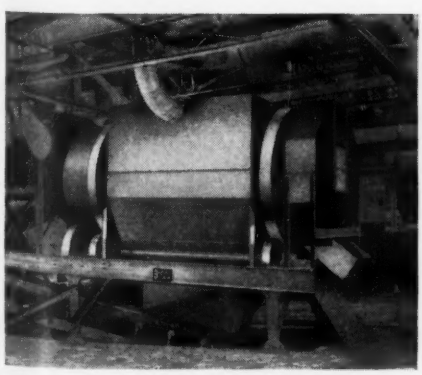
(*Continued on page* 141)



bove: 72'' dia. by 28' Rotary Screen in large Southern Foundry, showing Dust Hood and Discharge Chute.



Same Screen as above; Dust Hood and Discharge Chute Removed.



Rotary Cooling Screen with Dust Hood in large Detroit Foundry.

Cool Sand

improves production

● Bartlett-Snow Rotary Cooling Screens, like the one pictured above, lower the temperature of hot shakeout sand from 25° to 50° F. preparatory to storage and mulling. They break up the lumps and remove the rods, gaggers and other metal, so that only clean, cooled, screened sand is passed into the elevating, storage and mulling equipment.

Complete facilities, designed, fabricated and synchronized for faster production and lower costs. The C. O. Bartlett & Snow Company, 6201 Harvard Avenue, Cleveland 5, Ohio.

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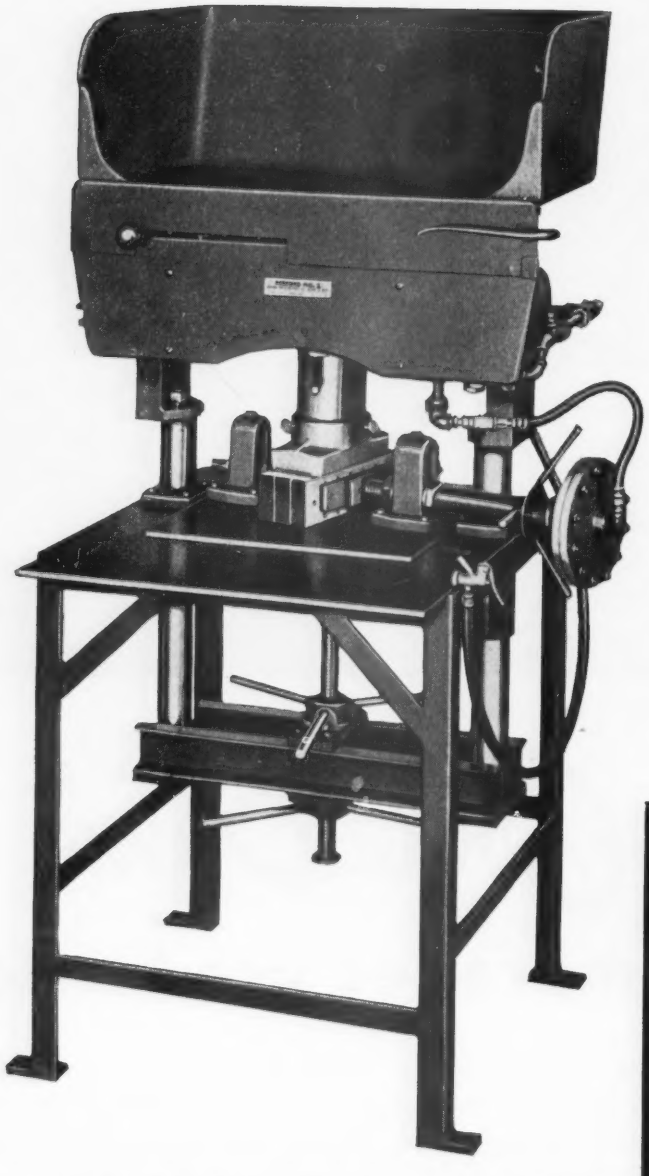
FABRICATORS ERECTORS

Redford CORE BLOWERS



REDFORD NO. 2 STATIONARY MAGAZINE TYPE CORE BLOWER . . . . .

New standards are being set with this machine, because every motion of your operator has been correctly evaluated to obtain a maximum of production with a minimum of effort.

8 OUTSTANDING FEATURES:

1. Large stationary work area.
2. Large sand supply hopper.
3. Stationary sand magazine.
4. Easy accurate locating of core boxes.
5. Quick change magazine heads.
6. Quick adjustment for different height core boxes.
7. Quick change, fully adjustable, vertical clamping attachment.
8. Actuating one handle clamps the core box, blows the core and releases the core box, in two seconds.

CAPACITY: Cores up to 5#

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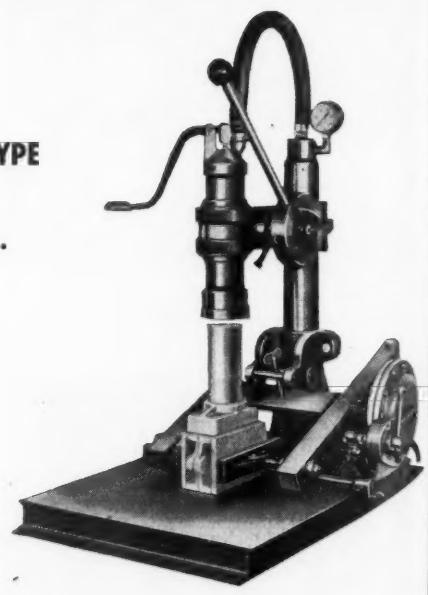
REDFORD CARTRIDGE TYPE BENCH CORE BLOWER . . . . .



The original small core blower . . Proven simplicity, speed and flexibility. Makes cores up to 2#.

Thousands in use in American Foundries . .

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Redford IRON & EQUIPMENT CO.

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20733 GLENDALE AVENUE • DETROIT 23, MICHIGAN

(*Continued from page* 138)

row for periodically closing to facilitate slag removal.

The function of the tuyeres is to conduct equal quantities of air from the wind box into the cupola in order to produce uniform combustion conditions throughout the entire coke bed.

It is sufficient to have the proper area, 20-25 per cent, keep them clean and in good repair.

Bridging and slagging over of the tuyeres is seldom caused by the tuyeres themselves.

Well—This is the section directly below the tuyeres and is a relatively inactive zone. It collects the metal and slag melted from the stock above the bed and permits the two to separate. No air exists in the well because the air flows upward above it, and the slag on the metal prevents any air contact with the metal at this point. This is actually a deoxidizing zone, because of the absence of air and further because the hot metal is in contact with incandescent coke (a reducing medium).

To determine the metal capacity of the well:

Operating height = distance from sand to bottom of the slag hole. Volume capacity of well = $\pi R^2 H$, where R = ½ well diameter and H = operating height of the well. Divide this result by 2 to obtain metal volume. (This allows for the space occupied by the coke which normally would be approximately 50 per cent.) Weight of metal in well (lb) = metal volume. (cu in.) × 0.26.

The actual volume of metal in the well will be somewhat less than that calculated above because of the slag.

At the front of the cupola is located the tap hole—through which the iron is drawn off. This is sized in accordance with the rate of melting (cupola size) or the shop demand or schedule. Cupolas on continuous tapping require smaller holes than those with intermittent (plug-and-tap) flow. No standard formula of sizing the tap hole is possible where intermittently tapped, because of the various shop practices.

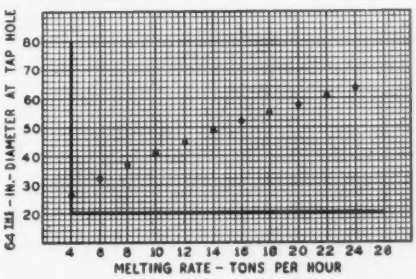
Frequently two tap holes are used, one located about 2 in. directly above the regular hole. This is used as an emergency if the lower hole plugs up and also to increase the draw if the shop requires additional iron momentarily.

The tap hole is located directly on the floor or bottom of the cupola so that all the iron may be withdrawn. Hole is constructed either by hand, using a stiff plastic refractory mix, or is purchased as a tap hole block, a recessed fired refractory, or a fire brick may be drilled for use.

Because of the slag action the tap hole is generally replaced after each heat. The construction is generally referred to as the breast. Older cupolas had a recessed front in the shell, while the modern cupola simply has a cut-away hole in the shell, and the breast is built flush with the outer shell surface. The inside or breast is recessed to shorten the tap hole, because long tap holes are conducive to freezing.

After constructing or installing the tap hole it is well to fill with dry or damp sand or a core plug from the inside, to prevent cold iron getting into it, and "botted" up from the front.

The tap hole must be carefully constructed so that run-outs cannot occur during the heat. The old brick or refractory is cleaned thoroughly and a thin layer of stiff "mud" placed up



Diameter of tap hole required to deliver iron at a given rate. (Chart from *Handbook of Cupola Operation*, AFS, 1946, based on data by D. J. Reese, "How Shall I Slag My Cupola," *Foundry*, November 1937, p. 96)

front against the shell. The brick is pressed hard against this and then additional refractory is tamped hard and shaped as a funnel toward the hole.

All breasts and tap holes must be slowly dried before use to prevent cracking.

Erosion in the well can be severe from: 1. Highly fluid and alkaline slags. 2. Unbalanced tuyeres causing excessive air action.

Generally the well is only cleaned each day—with minor repairs.

Contrary to general belief the well is the zone of least carbon absorption, contributing probably not over 5 points, which will represent the approximate difference between continuous and intermittent tapping; continuous tapping produces the lower absorption.

The well varies in depth due to different shop practices. Today's cupolas generally are designed to produce about 20 inches from the tuyeres to the sand bottom. Changing location of tuyeres, etc. will, of course, alter effective depth of well.

Again no standard can be suggested because of variations in practice or demand.

Slag Hole—

Rear—This is the most common form and generally located in the rear of the cupola directly opposite the tap hole. The location should be 3 to 5 in. below the tuyeres to allow a safety factor and prevent overflow into tuyeres. Its size should be 1¼ to 2 in. If less than 1¼ in. there is a tendency to freeze, and it should not exceed 2 in. because of the excessive air action.

It can be constructed by hand using a plug around which is tamped the plastic, or a refractory block or a silicon carbide block. This latter has proved very satisfactory particularly for long heats. The length of the hole should be limited to 9 in. Longer holes tend to freeze more easily.

Some cupolas operating for a long period install two slag blocks, side by side, to serve in an emergency if the first one freezes up.

Front Slagging—This is the newer method of removing slag from the cupola, and employs the principle of allowing the metal and slag as melted to discharge together from the cupola, retaining only enough in the well to seal the tap hole. A dam in the runner in front of the cupola permits the separation of the slag from the metal.

This is the preferred method because it permits continuous tapping (more regular metal composition) and eliminates the dirt from rear slagging, and further eliminates rear slag hole freeze-ups.

The front slagger has greater flexibility of varying melting rates than published tables show.

The construction of the front slagger has been fairly well standardized and can be constructed by the shop itself or obtained from a manufacturer.

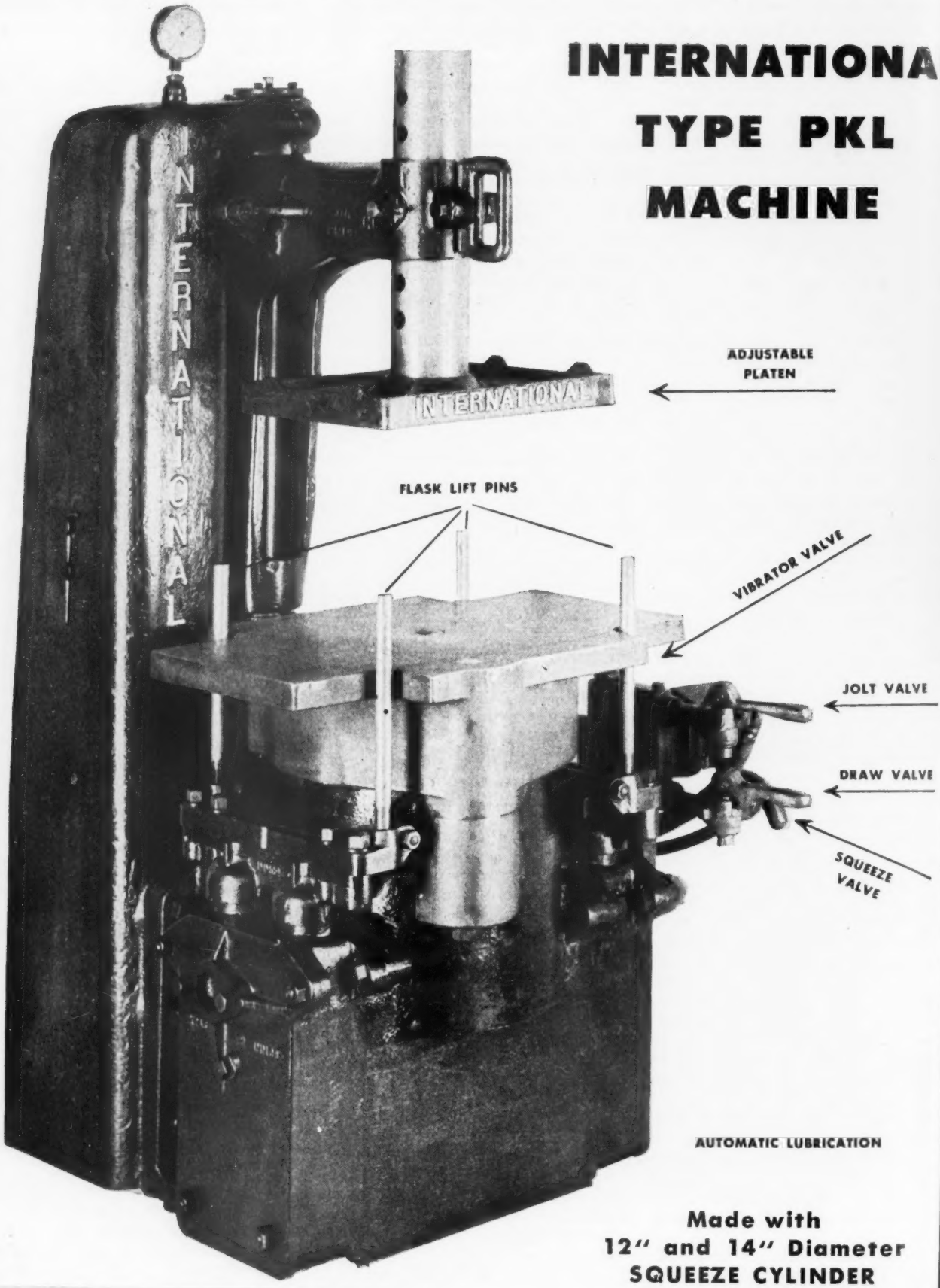
Because the cupola is drained through the front slagger it must be reconstructed for each heat. This requires more work than the ordinary runner repairs and some shops construct these in advance. The design of these slaggers permits their detachment for these repairs.

Slag Disposal—Whether the cupola is slagged in front or rear there remains the problem of slag disposal.

The quantity of slag formed will vary from 75 to 150 lb per ton of iron melted, and is a function of the amount of flux added, the dirt on the scrap and the sand adhering to the returns. This quantity, therefore, becomes a considerable problem of dis-

(*Concluded on page* 144)

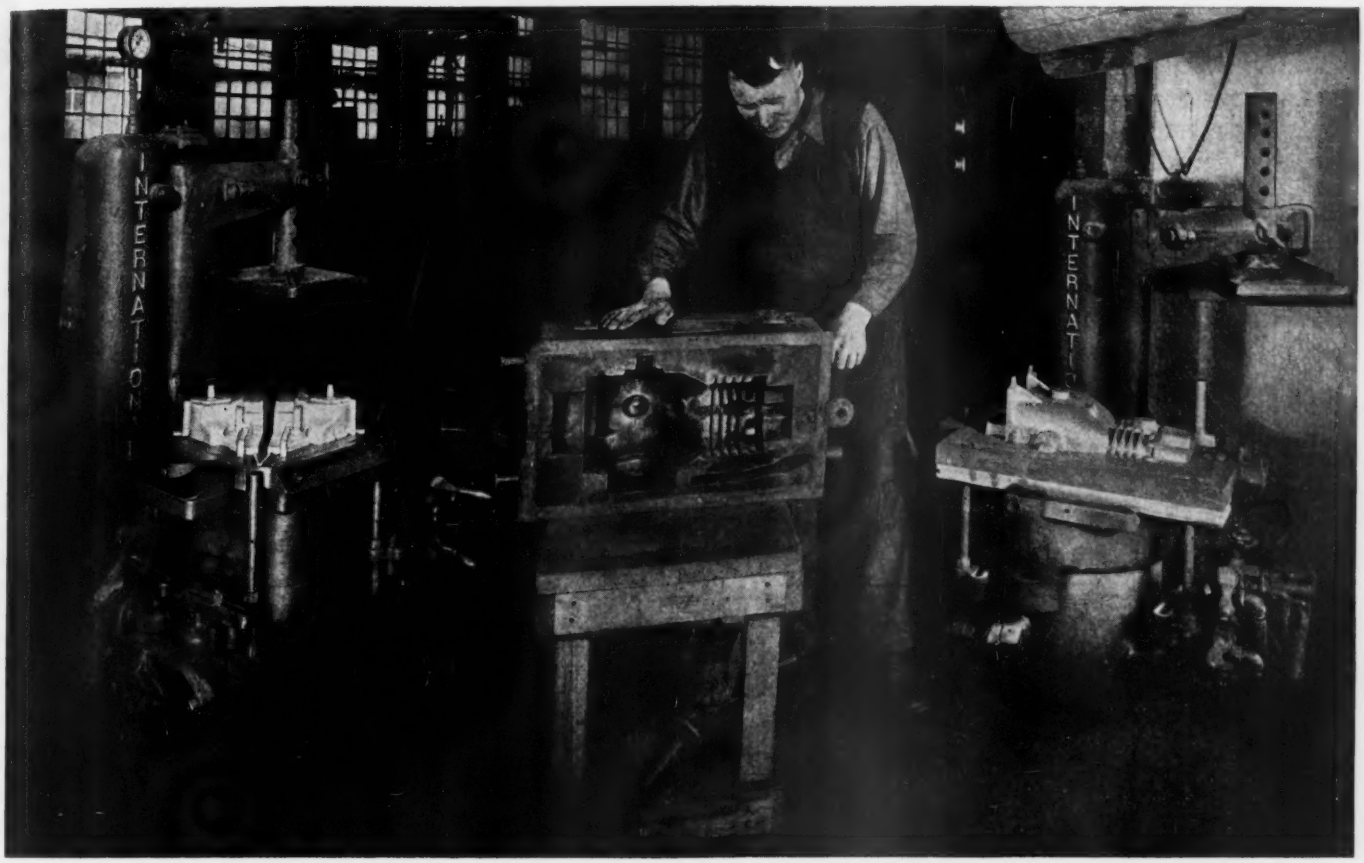
INTERNATIONAL TYPE PKL MACHINE



Made with 12" and 14" Diameter SQUEEZE CYLINDER

INTERNATIONAL MOLD

LA GRANGE, [illegible]



INTERNATIONAL TYPE PKL MACHINE

JOLT, SQUEEZE, AIR PIN LIFT

This machine is of a very rugged character. The column, squeeze head and platen are made of cast steel. The squeeze cylinder, squeeze piston, jar cylinder and jar table are made of wear-resisting iron.

All parts subject to wear have replaceable bushings of either brass or hardened steel. There is a threaded adjustment on the lower ends of the lift posts so that they can be set at the right height to suit the thickness of the pattern plates to be mounted, and the centers of the lift posts can be readily set to suit the sizes of flasks to be used,—note specifications on the following page. Type PKL comes equipped with pop valves, air gauge, vibrator and cleaner valve.

NG MACHINE COMPANY

RK, ILLINOIS

(*Concluded from page* 141)

posal.

It is handled as follows:

1. Allowing to run on floor and later broken and removed by wheelbarrows.

2. Collected in wheelbarrows or ladles as tapped, removed as collected.

3. Collected in ladles operating on a monorail.

4. Wet disposal. Run into trough directly from cupola, with a stream of water playing on it, into a disposal basin, where a basket catches the granulated slag and is periodically removed.

No. 4 is the preferred method because of its ease of disposal. The pit should be located outside the cupola building to avoid steam formation around the cupola. The granulated slag makes an excellent "fill," and most shops have no difficulty in its disposal in contrast to normal bulky slag.

The water in the slag pit can be recirculated.

New Research Laboratory

An illustrated brochure recently was published by Universal-Rundle Corp., New Castle, Pa., manufacturer of plumbing fixtures, to mark completion of 50 years in industry and dedication of its recently completed research laboratory. Booklet describes the highlights of the dedication ceremony and furnishes a picture-word tour of the laboratory with interesting information about the history and background of the company, its aims and plans for the future. The laboratory, dedicated to W. Keith McAfee, late chairman of the board of Universal-Rundle, is under direction of Dr. A. L. Johnson, who heads a large staff engaged in extensive research in ceramics, metallurgy, chemistry and hydraulics.

Book Review

Backgrounds of Power, by Roger Burlingame, cloth, 372 pages 6½ x 9½ in., published by Charles Scribner's Sons, New York. Price $5.

The human story of mass production, its origin as isolated ideas, the combination of these ideas over a long period of time, and problems created, are presented. The author shows that while mass production is regarded as an American phenomenon, most of the techniques, materials and philosophy have been imported. The book is intended for those who are more interested in men than machines, but perhaps those having some interest in production problems should not pass it up without examination.

Plaster Molds Give Close Tolerances

(*Concluded from page* 79)

solidified, the hold-down plates are released, and the molds are taken to the adjoining shakeout department where they are broken away from the gates and castings. Plaster from the broken molds is waste material, and is carried on an inclined conveyor belt to an elevated storage bin outside the building for disposal.

Castings are transported to the cleaning department where they are subjected to high-pressure water streams to remove any adhering plaster. Castings are allowed to dry, and the individual castings removed from the gates on high-speed bandsaws and on abrasive cut-off wheels. Castings then are placed in small tote boxes and sent to storage, or to the finishing department for final operations such as grinding, filing, belt sanding, drilling, etc., where required.

Metal Melted in Crucibles

Alloys for the castings are melted in eight gas-fired pit-type, crucible furnaces. The furnaces are located in a line along one wall of the melting department separating it from the remainder of the foundry. On the opposite side of the room are storage bins for ingot metal and scrap, furnace refractories, etc. Melting is conducted under controlled conditions, and temperatures are taken on each crucible just before pouring to obtain the most satisfactory results. Yellow brass No. 10 is used in greater quantity than any other composition. It is lowest in cost and will meet the requirements of most ordinary brass metals. Its physical strength is good. Its toughness rating is somewhat higher than the average bearing brass but it can easily be machined. It has a wide application in miscellaneous castings where unusual physical requirements are not a factor. Typical uses are brackets, brush holders, frames, ornamental castings, etc.

Manganese bronze XX is a high-strength material, with a minimum tensile strength of 95,000 psi and yield strength of 60,000 psi. Hardness averages 190 brinell. This alloy is used largely for gears, clutches and other types of castings requiring unusual wear-resisting characteristics and where stress concentration is high. The metal casts easily and will reproduce excellent detail. It has lower ductility than some of the other alloys due largely to the manganese content and its resultant high tensile strength. It is not as easily machined as yellow brass, but with the aid of carbide-tipped tools it handles satisfactorily. Corrosion resistance is good.

Aluminum bronze is next in line to manganese bronze in physical strength application. It has a higher ductility and is unusually tough. Resistance to shock and impact loading is good. Wearing qualities are excellent. Although it is not entirely free-machining, it can be cut rapidly with the proper carbide-tipped tools. Threading can be accomplished satisfactorily. The alloy has good corrosion-resisting properties and finds considerable application in pump impellers, valve parts and bodies, gears and levers. It has a tensile strength of 83,000 psi and a yield strength of 30,000 psi.

Nickel brass has good ductility and corrosion-resistant qualities. Nickel content adds materially to corrosion-resistant properties. It is used in lock cases, handles and ornamental designs, where a white metal finish is required on exposed parts. It also has a limited use in dairy equipment and food processing machinery. It casts well in the foundry and is produced as one of the standard alloys. The cast surface is unusually smooth and glossy. With a casting of nickel brass alloy, very little polishing is necessary to give it either a white satin or mirror finish. Surface porosity is well controlled and rarely appears as an objectional defect in polished surfaces.

Nickel brass 22 per cent has essentially similar physical characteristics to 15 per cent nickel. Uses are confined largely to food processing equipment and dairy equipment. It is almost always subject to highly polished finishes in its end uses. Metal structure must be dense and highly polished surfaces free from porosity. This is particularly true when the surfaces of the casting are in contact with food. Any surface porosity which would permit secretion of bacteria would promptly disqualify the casting. Because of its wide use in dairy equipment it has acquired the trade name of Dairy Metal. When given a high polish it has a luster comparable to that of stainless steel.

Spectrographers To Meet

American Association of Spectrographers has announced a symposium to be held in Chicago, May, 1951, on the "Use of Spectroscopy in the Steel Industry." Papers are invited from members or nonmembers on any phase of the subject. Titles of contributions should be sent at the earliest possible date to Ralph H. Steinberg, 9531 Avalon Ave., Chicago 28.

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Midget Cupola

Used in Research Work

THE midget cupola shown in the accompanying illustration is operated in the engineering department of the United States Graphite Co., division of the Wickes Corp., Saginaw, Mich. It is used in connection with research pertaining to foundry practice associated with the use of the company's graphite products. Pertinent dimensions include: Shell 7 in. ID; Lining 4½ in. ID; total height 30 in.; tuyeres, six equally spaced ½ in. diam; slag hole ⅝ in. diam, 1½ in. below tuyeres; tap hole ¾ in. diam, adjustable from 2½ to 5 in. below tuyeres.

The shell is a 30-in. length of steel pipe. The base plate 4½ in. ID and 12 in. OD, is welded to the lower end of the pipe. The windbox, 14 gage welded steel construction, has six peep holes opposite the tuyeres. An opening near the top at one side is provided for compressed air line connection. A ¼-in. manometer connection is on the opposite side on top of the windbox.

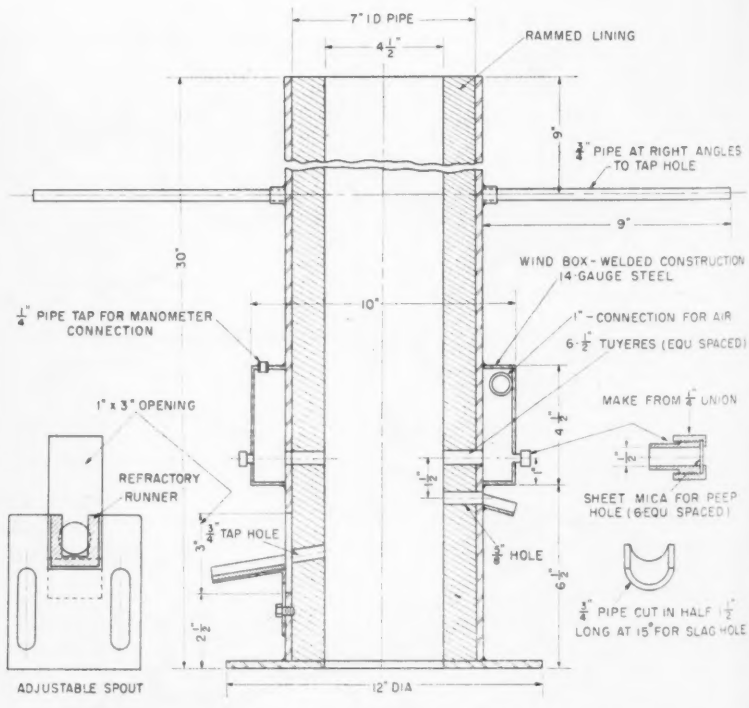
A monolithic lining 1½ in. thick is rammed in place between a section of 4½ in. pipe and the shell. The pipe is drawn up as the ramming progresses. Tuyere openings are formed by inserting ½-in. steel rods through the peep holes and through the shell and lining material. A satisfactory lining mixture contains the following: Ground fire brick 40 per cent, 12 mesh fire clay 40 per cent, Mexaloy (graphite) 20 per cent, all measured by weight. Moisture ranges from 6 to 8 per cent.

The sand bottom is rammed over a refractory block and the cupola rests on a sand base during the operating period. When the time comes to drop the bottom, two attendants grasp two lengths of ¾-in. steel pipe welded to opposite sides of the shell and at right angles to the tap hole. The cupola is lifted from the foundation and placed a short distance away.

In preparation for the heat the sand bottom is rammed in place and the coke bed built up to the level of the tuyeres. The flame from a blast lamp outside the tap hole ignites the coke. With the coke burning nicely, additional coke is built up to a height of 6 or 7 in. above the tuyeres. A small flow of air through the bed coke is maintained for about an hour before any other material is charged. This is to preheat the lining. Experience indicates that this is necessary to prevent cold iron and a frozen tap hole.

After the cupola has been preheated in this manner, the coke bed height is adjusted and the iron, coke and limestone are added in the usual manner. A typical charge contains 2½ lb iron, broken small; 5 oz coke ¼ to ¾ in. mesh; 1 oz limestone ¼-in. or less.

Molten iron appears at the tuyeres approximately 8 minutes after the blast is applied. The cupola is tapped intermittently and yields approximately 6 lb of metal per tap. In the early experiments with fine coke the blast pressure was 10 oz. Later, and at present with a slightly coarser grade of coke, the blast pressure is 5 oz recorded on a water manometer in the air line.



Sectional view showing constructional details of 4½-in.-diameter cupola. The small unit in operation is shown at left

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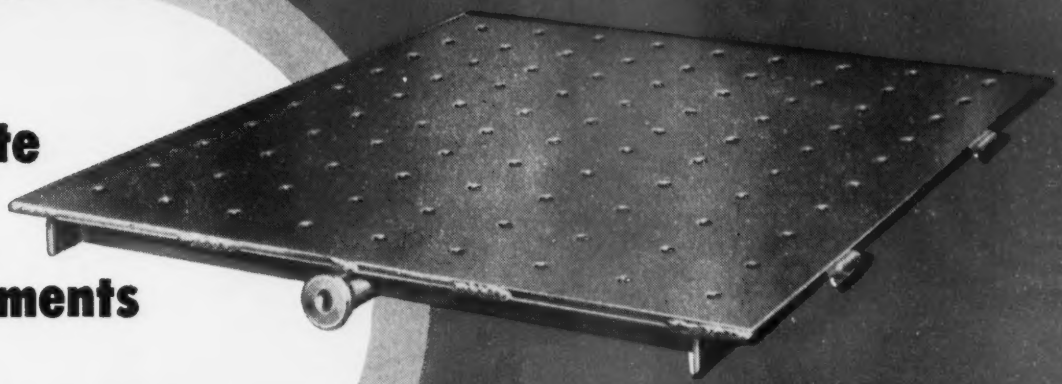
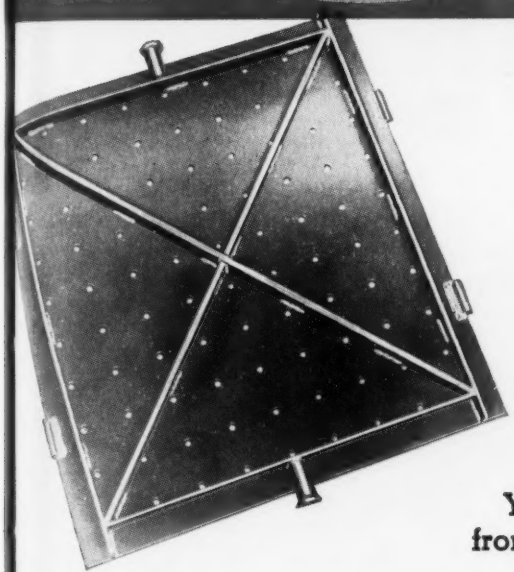


BS&B STEEL BOTTOM BOARDS and CORE PLATES



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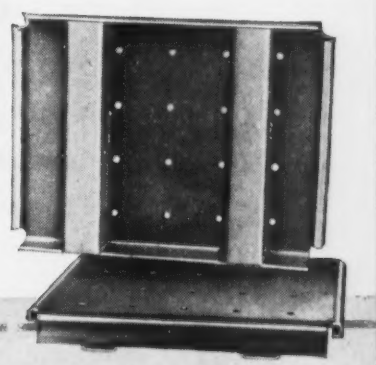

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Foundry STATISTICS

Malleable Iron

(Shipments of castings—net tons[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1948	933,265	525,212	.....
1949			
Sept.	60,723	30,781	57,512
9 mo.	668,206	348,811	.....
Oct.	57,150	28,582	54,322
Nov.	49,439	25,250	55,795
Dec.	57,379	29,679	60,835
Total	713,330	371,214	.....
1950			
Jan.	62,874	32,918	62,307
Feb.	60,386	31,249	67,049
Mar.	66,259	38,639	69,866
Apr.	69,822	36,279	76,250
May	76,161	42,432	77,074
June	82,345	46,613	86,783
July	67,514	37,198	105,300
Aug.	86,021	50,019	132,374
Sept.	82,479	46,927	152,583
9 mo.	653,861	362,274	.....

Copper-base Alloy

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—Sand	Shipments—Perm. Mold	Unfilled Orders[2]
1948	1,030,825	930,790	59,009	.....
1949				
Sept.	60,771	55,221	2,729	26,527
9 mo.	540,592	486,623	29,098	.....
Oct.	58,249	52,861	2,316	23,634
Nov.	61,818	56,669	2,811	23,625
Dec.	63,873	58,291	3,086	23,435
Total	725,318	654,444	37,311	.....
1950				
Jan.	65,585	58,878	3,440	25,216
Feb.	67,029	60,257	3,626	26,923
Mar.	80,442	71,876	4,693	27,631
Apr.	72,318	64,773	3,848	28,769
May	79,108	71,605	3,751	30,880
June	83,023	74,990	3,896	32,808
July	69,033	62,414	3,789	39,906
Aug.	94,013	85,948	4,258	52,513
Sept.	95,641	87,111	4,630	58,673
9 mo.	705,691	637,852	35,931	.....

Aluminum

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—Sand	Shipments—Perm. Mold	Shipments—Die	Unfilled Orders[2]
1948	424,490	139,781	161,334	118,738	.....
1949					
Sept.	27,546	9,923	9,491	7,623	38,179
9 mo.	222,352	77,909	76,956	62,219	.....
Oct.	29,071	9,634	9,923	8,908	37,881
Nov.	26,317	9,212	8,315	8,348	36,846
Dec.	26,762	10,070	7,714	8,430	36,921
Total	304,616	106,825	102,908	88,019	.....
1950					
Jan.	28,801	9,646	9,400	9,052	40,591
Feb.	28,887	10,171	9,358	8,851	44,235
Mar.	35,845	13,035	11,094	10,870	47,350
Apr.	33,356	11,091	10,656	10,795	49,952
May	36,031	11,526	11,928	11,799	52,580
June	37,600	12,677	11,825	12,173	53,309
July	32,794	10,393	11,276	10,337	70,940
Aug.	39,852	14,117	12,682	12,207	82,564
Sept.	42,061	14,369	13,085	13,594	89,723
9 mo	284,825	104,961	100,345	175,345	.....

Magnesium

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1948	8,214	7,488	....
1949			
Sept.	727	691	3,015
9 mo.	6,986	6,511	....
Oct.	796	763	3,050
Nov.	801	769	2,399
Dec.	781	738	2,216
Total	9,364	8,781	....
1950			
Jan.	814	762	2,237
Feb.	735	676	2,218
Mar.	903	849	2,322
Apr.	799	751	2,305
May	810	762	2,282
June	758	698	2,482
July	763	713	3,587
Aug.	1,147	1,078	4,855
Sept.	1,231	1,154	4,942
9 mo.	7,924	7,407	....

Foundry Production Workers

Estimated Number

	Sept. 1950	Aug. 1950	Sept. 1949
Iron & Steel	221,800	213,200	174,000
Nonferrous	84,900	81,300	62,000

Average Weekly Earnings

Gray Iron	$68.70	$66.67	$55.18
Malleable Iron	68.47	65.76	54.11
Steel	66.27	65.99	53.81
Nonferrous	70.15	66.28	61.66

Average Weekly Hours

Gray Iron	43.1	42.6	37.9
Malleable Iron	42.5	41.7	35.0
Steel	41.6	41.9	35.4
Nonferrous	42.8	41.5	39.4

Labor Turnover Rate (Aug.)

(Per 100 employees)

	Total Accession	Total Separation	Quit	Layoff
Gray Iron	8.6	4.9	3.2	0.5
Malleable Iron	11.3	6.0	5.0	n.a.
Steel	10.2	3.9	2.8	0.4
Nonferrous	9.2	4.4	3.0	0.5

Source: Bureau of Labor Statistics.

Gray Iron Castings—Shipments

(Net tons[1])

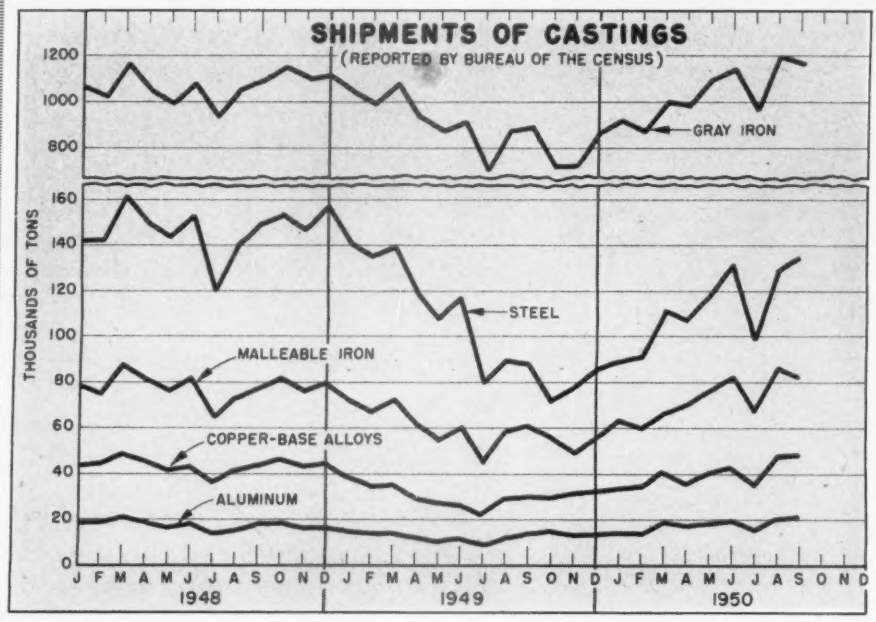
	All Castings—Total	All Castings—For Sale	Miscellaneous Castings—Total	Miscellaneous Castings—For Sale	Heavy Steel Ingot Molds—Total	Heavy Steel Ingot Molds—For Sale	Chilled Railroad Car Wheels—Total	Chilled Railroad Car Wheels—For Sale	Pressure Pipe & Fittings—Total[2]	Soil Pipe & Fittings—Total[2]	Unfilled Orders[3] Total
1948	12,785,909	7,131,405	8,296,843	3,839,671	1,979,740	865,022	719,784	641,164	1,149,553	639,989	.....
1949											
Sept.	880,647	459,014	570,781	233,836	128,363	48,912	37,791	32,763	86,262	57,450	980,070
9 mo.	8,252,724	4,286,887	5,074,469	2,038,286	1,522,238	641,632	449,029	400,445	813,337	393,651	.....
Oct.	715,685	397,939	539,262	229,570	7,407	4,367	33,762	29,067	79,003	56,251	955,100
Nov.	718,703	395,107	489,076	206,795	62,937	26,620	38,006	33,324	71,639	57,045	938,629
Dec.	862,172	440,409	521,613	200,760	183,660	87,241	34,772	30,281	65,764	56,363	892,458
Total	10,549,284	5,517,527	6,624,420	2,675,411	1,776,242	759,860	555,569	493,117	1,029,743	563,310	.....
1950											
Jan.	913,321	449,577	573,743	214,752	188,152	88,244	34,254	29,409	64,095	55,077	914,185
Feb.	864,189	416,594	551,060	201,468	169,605	75,832	33,417	29,187	63,363	46,744	873,455
Mar.	995,782	500,195	635,403	244,122	170,082	71,317	44,898	39,357	89,264	56,135	921,575
Apr.	981,126	483,862	621,368	233,397	182,420	77,923	42,768	37,972	82,774	51,796	922,255
May	1,095,111	572,887	684,632	277,447	195,021	86,016	46,219	40,185	104,529	64,710	977,833
June	1,136,129	613,084	713,811	300,863	197,474	91,377	45,672	41,672	106,980	72,192	1,039,619
July	961,450	507,867	595,918	241,632	177,154	82,363	35,066	30,560	94,438	58,874	1,286,579
Aug.	1,201,569	677,134	747,046	335,868	199,770	92,340	52,508	46,681	131,127	71,118	1,670,380
Sept.	1,159,240	648,966	722,667	325,019	203,191	94,968	44,707	40,304	121,556	67,119	1,794,118
9 mo.	9,307,917	4,870,166	5,845,648	2,374,568	1,682,869	760,380	379,509	335,327	858,126	541,765	.....

Steel Castings—Shipments

(Net tons[1])

	All Castings—Total	All Castings—For Sale	All Castings—Railway Specialties[3]	Carbon Steel—Total	Carbon Steel—For Sale	Carbon Steel—Railway Specialties[3]	Alloy Steel—Total	Alloy Steel—For Sale	Alloy Steel—Railway Specialties[3]	Unfilled Orders[3] Total
1948	1,760,032	1,335,295	442,258	1,366,913	1,063,027	425,965	393,981	272,374	16,293	.....
1949										
Sept.	87,117	55,853	11,823	65,376	41,148	11,413	21,126	14,705	410	127,664
9 mo.	1,017,312	713,270	207,484	775,618	551,865	199,019	236,249	161,405	8,465	.....
Oct.	71,295	48,263	8,964	53,118	35,163	8,650	17,572	13,100	314	124,817
Nov.	76,820	50,685	7,270	54,632	35,221	6,810	21,805	15,464	460	117,865
Dec.	85,033	53,079	9,258	60,864	37,205	8,831	23,644	15,874	427	122,887
Total	1,250,460	865,297	232,976	944,232	659,454	223,310	299,270	205,843	9,666	.....
1950										
Jan.	88,821	57,996	9,298	64,616	41,559	8,607	24,205	16,437	691	142,484
Feb.	91,827	62,045	10,920	66,843	44,473	9,589	24,984	17,572	1,331	165,186
Mar.	114,772	77,588	15,281	82,458	56,492	14,012	29,314	21,096	1,269	185,611
Apr.	106,964	75,133	17,406	79,912	56,008	16,124	27,052	19,125	1,282	201,643
May	117,944	83,845	20,552	88,202	63,658	18,811	29,742	20,187	1,741	198,078
June	131,097	94,637	27,065	96,365	72,427	24,653	34,732	22,210	2,412	206,799
July	98,269	68,874	15,734	70,122	51,204	14,577	28,147	17,670	1,157	255,418
Aug.	128,369	94,413	24,922	92,197	70,721	22,952	36,172	23,692	1,970	329,944
Sept.	134,574	96,738	25,295	98,523	74,052	23,992	36,051	22,686	1,303	427,969
9 mo.	1,010,922	711,269	166,473	739,238	530,594	153,317	270,399	180,675	13,156	.....

[1] Source: Bureau of the Census. [2] All cast iron pipe is shipped for sale. [3] For sale only.



Index of Foundry Equipment Orders

Foundry Trades Only

(Net Orders Closed, New Equipment)

	1949	1950
Jan.	149.9	159.3
Feb.	144.4	113.1
Mar.	190.8	225.2
Apr.	172.0	160.6
May	121.9	294.9
June	164.9	622.7
July	146.6	401.8
Aug.	127.1	693.6
Sept.	166.6	483.8
Oct.	133.5	....
Nov.	270.4	....
Dec.	201.0	....

Note: Figures are percentages of the base period 1937-1939 taken as 100 per cent (monthly average). Source: Foundry Equipment Manufactures Association.

Coke Production and Consumption

(Net tons*)

	Production	Consumption Total	Consumption By Foundries
1948	74,861,928	74,214,497	3,750,300
1949			
Sept.	4,981,373	5,040,829	227,056
9 mo. ..	52,590,820	52,086,707	2,067,551
Oct.	1,735,695	1,553,836	223,698
Nov.	3,504,656	3,618,796	215,299
Dec.	5,617,906	5,903,287	228,203
Total ..	63,449,077	63,162,626	2,734,751
1950			
Jan.	5,461,719	5,878,562	255,224
Feb.	3,982,336	4,626,521	202,239
Mar.	5,226,489	5,330,772	240,961
Apr.	6,087,079	5,941,701	277,098
May	6,313,632	6,310,454	293,056
June	6,225,024	6,245,877	276,521
July	6,359,566	6,274,054	267,037
Aug.	6,399,936	6,404,004	270,411
Sept.	6,244,285	6,226,380	267,698
9 mo. ..	52,300,066	53,238,325	2,348,245

Ingot Brass and Bronze

(Shipments in net tons)

	1949	1950
Jan.	19,456	18,874
Feb.	15,026	18,487
Mar.	14,550	22,494
Apr.	10,695	22,118
May	11,114	23,643
June	9,696	25,093
July	10,220	21,609
Aug.	14,194	29,689
Sept.	16,208	28,811
Oct.	18,036	32,240

Source: Ingot Brass and Bronze Industry

Castings Production

In Philadelphia Federal Reserve District

(October, 1950)

Type	Percentage Change From Sept., 1950	Oct., 1949
Gray Iron	+17.2	+ 53.5
Malleable Iron	+35.5	+182.0
Steel	+ 4.0	+ 20.6
Nonferrous	+11.5	+110.0

Source: University of Pennsylvania.

Iron and Steel Scrap Consumption

(Thousands of gross tons*)

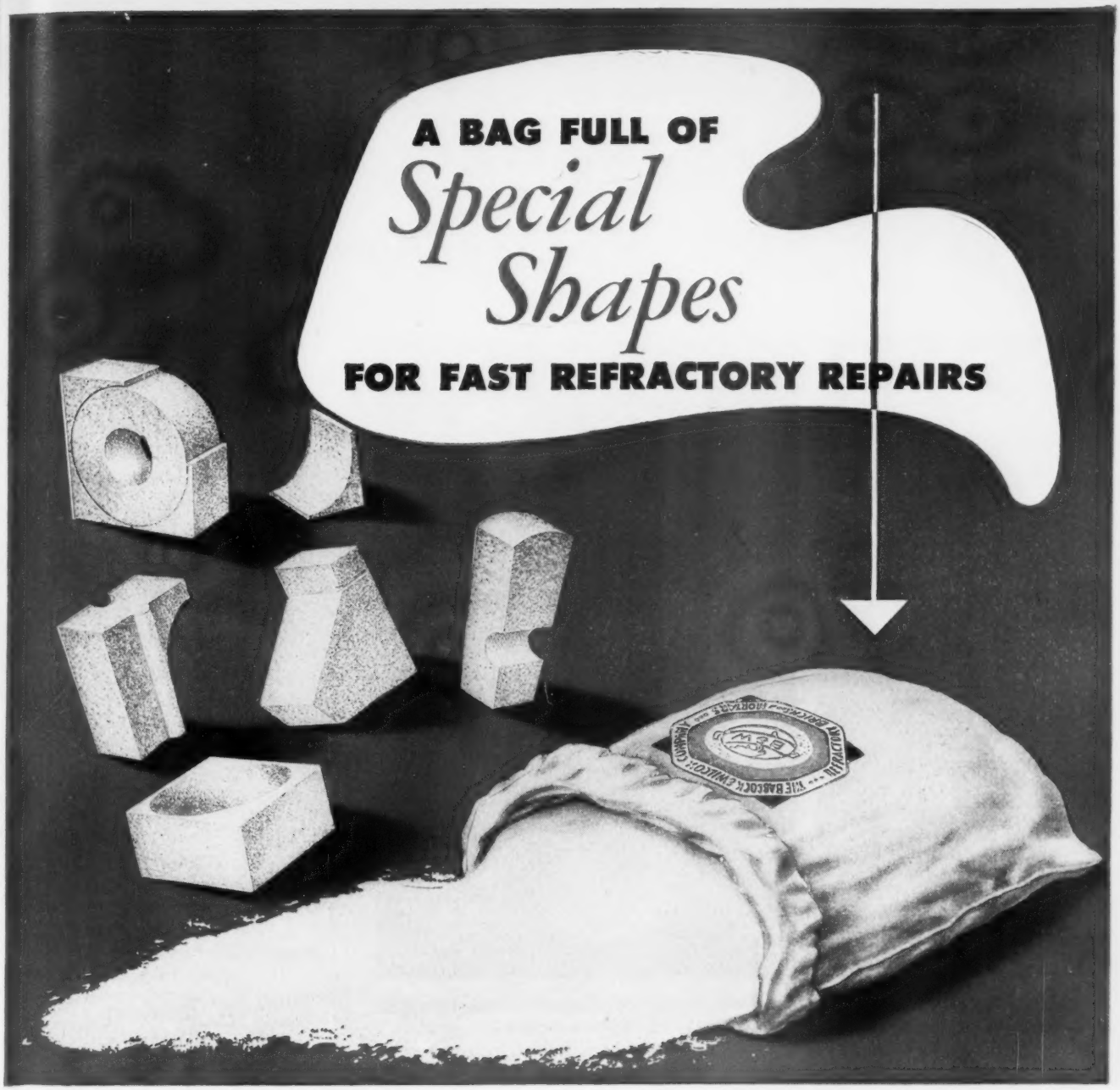
	All Scrap		By Type of Furnace: Cupola		Air		Electric	
	Total	Purchased	Total	Purchased	Total	Purchased	Total	Purchased
1949								
Aug.	4,247	1,794	712	334	66	22	298	167
8 mo.	35,873	16,694	5,347	2,899	559	195	3,113	1,936
Sept.	4,135	1,762	702	329	63	22	300	174
Oct.	1,486	803	641	305	59	19	156	85
Nov.	3,037	1,434	612	310	53	17	291	180
Dec.	4,750	2,229	666	332	67	23	379	233
Total	49,281	22,922	7,968	4,175	801	276	4,239	2,608
1950								
Jan.	4,906	2,267	699	337	71	25	433	259
Feb.	4,539	2,149	670	315	71	27	417	253
Mar.	5,101	2,430	778	372	87	31	497	296
Apr.	5,119	2,451	766	365	79	29	493	300
May	5,333	2,552	837	416	85	32	539	324
June	5,122	2,483	864	427	92	33	533	317
July	4,708	2,244	669	318	79	28	490	295
Aug.	5,202	2,454	862	426	108	39	568	327
8 mo.	40,030	19,030	6,145	2,976	672	244	3,970	2,371

Pig Iron Production and Consumption

	Production** (Standard grades—1000 net tons)					Consumption* (By type of furnace, 1000 gross tons)			
	Total	Foundry	Malleable	Basic	Low Phos. Intermediate Low Phos. & Bessemer	Total	Cupola	Air	Electric
1949									
Aug.	....	....	....	....	....	4,111	363	18	6
Sept.	4,303.4	204.5	186.0	3,305.5	607.4	4,013	384	18	9
9 mo.	44,953.0	2,241.8	1,839.6	34,982.3	5,889.3	40,124	3,458	183	75
Oct.	602.3	137.9	99.7	346.6	18.1	672	336	17	3
Nov.	2,687.5	192.5	131.3	2,024.0	339.7	2,476	331	15	5
Dec.	5,166.0	249.7	218.6	3,959.6	738.1	4,656	385	20	13
Total	53,408.7	2,821.9	2,294.5	41,312.5	6,979.8	47,928	4,510	235	96
1950									
Jan.	5,209.0	239.3	226.4	4,033.2	710.1	4,719	421	20	10
Feb.	4,120.1	151.1	187.9	3,239.3	541.8	3,890	396	20	80
Mar.	4,546.8	232.4	201.2	3,554.9	558.3	4,267	448	23	8
Apr.	5,502.8	259.2	229.1	4,298.3	716.2	4,954	449	23	11
May	5,773.6	257.7	223.5	4,572.3	720.1	5,203	474	24	13
June	5,549.3	209.5	257.7	4,393.8	688.3	5,033	494	25	13
July	5,804.2	269.3	282.2	4,561.2	691.5	5,018	403	23	14
Aug.	5,706.2	257.0	284.0	4,407.3	757.9	5,136	516	30	18
Sept.	5,614.6	244.0	257.2	4,380.9	732.5	5,092	500	26	17
9 mo.	47,826.6	2,044.4	2,224.3	37,441.2	6,116.7	43,312	4,101	214	184

* Source: U. S. Dept. of Interior, Bureau of Mines

** Source: American Iron & Steel Institute



WITH KAOCAST ON HAND, you don't have to carry an expensive inventory of special refractory shapes. You can make your own! This versatile 3000 F Refractory Castable can be used to mold shapes quickly and easily in your own shop . . . or it can be applied directly to the furnace lining by cement gun or by casting into place. In addition to cutting the cost of repairs, KAOCAST will increase furnace life because of its high resistance to spalling and slag attack.

And remember, KAOCAST is just one of B&W's *complete* line of Refractory Castables, all designed to reduce construction and maintenance costs in low, intermediate, and high-temperature furnaces.

If you have a problem with special shapes, investigate the cost cutting advantages of B&W Refractory Castables. For more information call your local B&W Refractories Engineer, or simply drop us a card asking for Bulletin R-22.

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R-374

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NEW SAND TESTING METHOD

Used To Eliminate Casting Defects

By W. H. MOORE
Meehanite Metal Corp.
New Rochelle, N. Y.

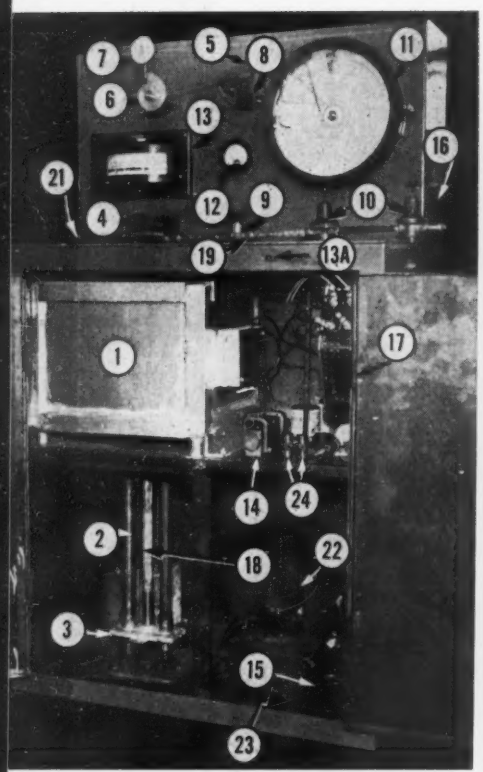


Fig. 1—New machine designed to test sand by disclosing maximum strength in the sand body. Functioning elements described in text

SAND control in the past has been largely directed toward lowering the stresses and forces produced in the sand when it is subjected to heat. It is a known fact that silica, the basis of all sands, exhibits a differential expansion when heated. This expansion leads to the development of rupturing forces within the sand body. In the same way, when a sand is heated gases are evolved, and in traveling through the sand body they set up back pressure forces which tend to fracture the sand.

By adjustments in the type of silica grain and in the type and amount of binders used in the sand, it has been possible to exercise limited control over these forces. However, this means that all control is largely uncertain because it is impractical to measure the extent of these rupturing forces completely and accurately.

Sand technologists of the Meehanite Metal Corp. have adopted a new approach to this problem. Their basis of reasoning is that if the strength of the sand or the ability of the sand to

(*Continued on page* 154)

Fig. 2—Showing variations in toughness of two molding sands after different soaking periods

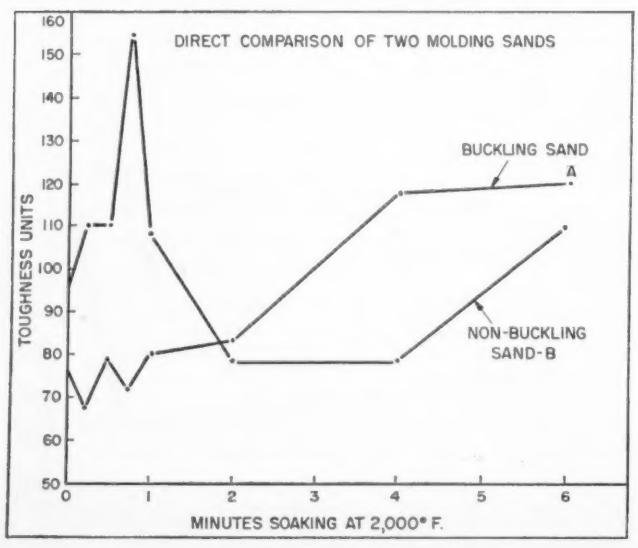
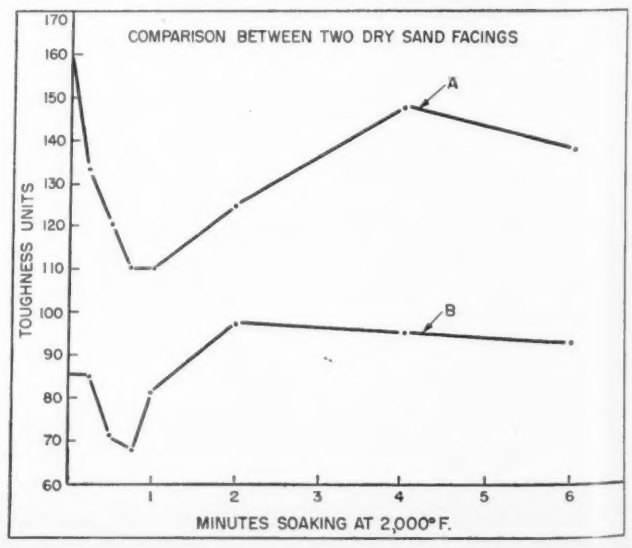


Fig. 3—Typical example of dry sand control by means of sand testing method described here



ADD THIS ABLE BODIED WORKMAN TO YOUR STAFF

—"he" will reduce casting rejects

"His" experience includes over thirty-two years of success in casting improvement.

Repeat orders from leading foundries who have used it regularly for years, are proof that Famous Cornell Cupola Flux plays an important role in attaining and maintaining better casting production and small scrap losses.

Famous Cornell Cupola Flux cleanses molten iron, makes it hotter and increases fluidity, greatly reduces sulphur, makes slag more fluid.

Castings are better. There is amazing freedom from chilled sides, machining is easier and smoother. hollow centers and hard spots, and Cupola maintenance is practically nil. Cupolas are cleaner, drops are cleaner and bridging over is greatly reduced.

This flux is also being used regularly in leading *malleable foundries* with cupola operation.

Write for Bulletin 46-B

SCORED BRICK
(Pre-Measured)
FORM
takes but seconds to use

No digging out of container. No weighing. No measuring. You simply toss Famous Cornell Flux into cupola with each ton charge of iron, or break off one to three briquettes (quarter sections) for smaller charges, as per instructions.

Famous CORNELL ALUMINUM FLUX

CLEANSES MOLTEN ALUMINUM so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive Formula greatly reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

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1026-1040 MAIN AVENUE, N. W.
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Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum Flux Since 1918

FAMOUS CORNELL FLUXES
Trade Mark Registered

Famous CORNELL BRASS FLUX

CLEANSES MOLTEN BRASS even when dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

(*Continued from page* 152)

resist these forces at a time when they are at their highest is controlled, the sand will not be ruptured or broken by the effect of heating. This is the same line of reasoning adopted in making a casting to certain physical properties. The casting is always intended to be made sufficiently strong to withstand the forces imposed upon it in use.

The emphasis of control is, therefore, placed on developing strength in the sand body to withstand rupturing forces rather than on reducing the rupturing forces to the point where they do not exceed the strength characteristics of the sand.

The reason for this line of approach is basically simple. To reduce expansion forces in a sand, an exact balance of the clay bond and the silica base has to be attained. This usually results in the use of sufficient clay to impair seriously the flowability of the sand which must be sufficiently high to provide a uniformly rammed mold with the expenditure of minimum time and effort.

Another means of reducing expansion forces is to increase the spread of the basic grain distribution of the silica particles so that we have, in effect, a mass of sand composed of varying sizes of particles. With such an arrangement we have the chance of relative movement or adjustment of the sand grains when they are subjected to heat. This relative movement prevents the build-up of a high stress concentration. Unfortunately, however, a grain size distribution consisting of many different size particles is subjected to many ills, the chief being that the smaller grains tend to fill in the spaces between the larger grains, thereby lowering the permeability or gas-carrying ability of the sand. Such a sand also is extremely sensitive to variations in degree of ramming which exists in almost any method of preparing a mold.

Still another means of reducing expansion forces is the use of wood flour or other cellulose material. The method of testing described here has shown that these materials also very definitely increase hot toughness, and it may well be that this accounts for their usefulness rather than the fact that they lower expansion forces.

Failure to control the effect of expansion and gas pressure forces will lead to the types of casting defects shown in the accompanying illustrations. By adopting the testing technique described in this article and changing the sand to conform to basic specifications with respect to hot toughness, it has been possible to eliminate entirely these costly defects in many cases.

The field of high temperature testing of sand has expanded considerably the last few years and methods of testing strength have, in general, narrowed themselves down to the following steps:

1. Preparation of a standard sample 1⅛-in. diameter by 2 in. high.
2. Soaking the sample at a preselected temperature for a preselected time.
3. Fracture of the specimen by the application of a compressive load while still under the influence of temperature.

This standard method of testing has given some very valuable information on the behavior of molding sands; however, it is the writer's opinion that use of a smaller diameter sample and a shorter heating time in the furnace will give us further information, particularly with respect to the expansion behavior of the sand. It has been reasoned that the sample must be brought entirely up to the chosen temperature if we expect to measure accurately the properties of the sample at this temperature. This is scientifically and theoretically correct, but the results do not always agree with exact casting conditions.

It is definitely known that most of the casting defects originating from a sand condition occur while the metal in the mold cavity is still in a liquid or semiliquid condition. In the case of light-section castings in particular, this represents a very short period of time—a fraction of a second—rather than in minutes. We are, therefore, interested in the behavior of a sand in this very short space of time and we desire to control the properties of our sand during this period of time.

If we adopt this premise, we find that normal breaking of the sample under a compressive load may actual-

(*Please turn to page* 176)

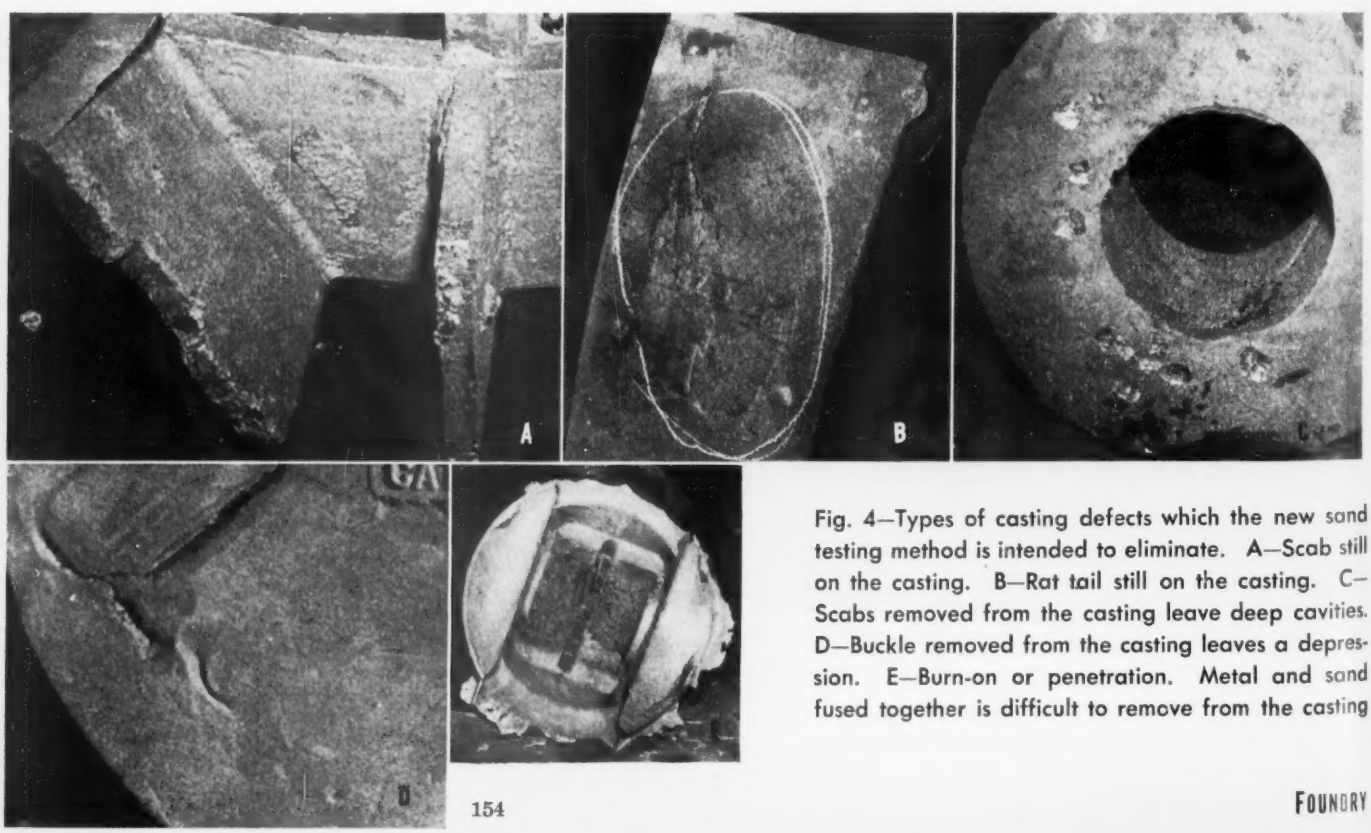
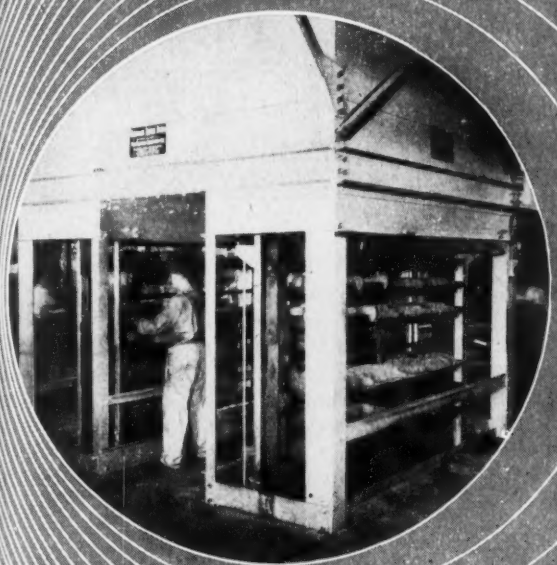


Fig. 4—Types of casting defects which the new sand testing method is intended to eliminate. A—Scab still on the casting. B—Rat tail still on the casting. C—Scabs removed from the casting leave deep cavities. D—Buckle removed from the casting leaves a depression. E—Burn-on or penetration. Metal and sand fused together is difficult to remove from the casting

Speed Baking Cycles

IN YOUR TOWER OVEN

—cut time for "one-trip" cores
—cut number of trips for large cores



MANY foundrymen using Tower or other conveyor-type ovens have found that "Truline" Binder promotes faster baking, speeds up core making two ways. First, small cores requiring only one trip through the oven are baked faster. Second, by replacing core oil with "Truline" Binder, large or chunky cores put through with smaller ones often need only one cycle to bake thoroughly. And large cores, formerly requiring three trips when baked along with "one-trip" cores can now be completely baked in two trips through the oven. Moreover, when cores require more than one cycle, there is no danger of disintegration.

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NF51-1

FOUNDRIES EXHIBIT AT NATIONAL METAL CONGRESS

OVER 40,000 attended the National Metal Congress and Metal Exposition sponsored by the American Society of Metals and held at the International Amphitheatre, Chicago, Oct. 23 to 27. Co-operating organizations which also met during the week included American Welding Society, Society for Non-Destructive Testing, and Institute of Metals Division, American Institute of Mining and Metallurgical Engineers.

A feature of the Metals Exposition was the exhibits of more than a dozen foundries which attracted close attention of numerous visitors. Half of the foundries exhibited castings made by the investment molding process. Exhibitors included the American Brake Shoe Co., New York, with its Brake Shoe & Casting, National Bearing Metal, American Manganese Steel, Electro-Alloys and Engineered Castings Divisions; American Non-Gran Bronze Co., Berwyn, Pa.; Alloy Engineering & Casting Co., Champaign, Ill.; Austenal Laboratories Inc., New York; Casting Engineers Inc., Chicago; Chicago Steel Foundry Co., Chicago; General Alloys Co., Boston; Haynes Stellite Division, Union Carbide & Carbon Corp., Kokomo, Ind.; Hitchener Mfg. Co. Inc., Manchester, N. H.; Howard Foundry Co., Chicago; Lynchburg Foundry Co., Lynchburg, Va.; Michiana Products Corp., Michigan City, Ind.; U. S. Pipe & Foundry Co., Burlington, N. J., and Universal Castings Corp., Chicago.

At the ASM business meeting, Walter E. Jominy, Chrysler Corp., Detroit, was elected president, and Prof. John Chipman, Massachusetts Institute of Technology, Cambridge, Mass., was elected vice president. Dr. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, and Dr. J. B. Austin, U. S. Steel Corp., Kearney, N. J., were elected trustees of the society. At the annual banquet, Clarence E. Sims, Battelle Memorial Institute, Columbus, O., was presented the Albert Sauveur Achievement Award.

A technical session held by the Society for Non-Destructive Testing under the direction of Justin Schneeman, X-ray Products Corp., Los Angeles, dealt with study of castings, and had three discussion leaders. T. E. Piper, Northrop Aircraft Inc., Hawthorne, Calif., described one of the first commercial fluoroscopic inspection units which his firm aided in developing for study of aluminum alloy castings. The unit, using 6 to 10 milliamperes at 100 Kv, served for castings up to ½-in. thick, and with 10 to 15 milliamperes at 150 kv penetrated 1⅛-in. of aluminum. The unit permits rapid inspection of castings for certain irregularities fluoroscopically visible. This supplemented the 100 per cent radiographic inspection to which the castings were subjected, and reduced the cost of the final radiographs.

T. D. O'Connor, substituting for his co-worker, J. J. Pierce, Naval Ordnance Laboratory, White Oak, Md., discussed a new tentative "Manual of Illustrations of Defects in Aluminum and Magnesium Castings" being developed by the Bureau of Aeronautics. It comprises radiographs with classification as to type of defect. Stanley A. Brosky, Pittsburgh Testing Laboratories, Pittsburgh, presented a paper on "Correlation of X-ray, Pressure Tests and Field Service on Nonferrous Castings," which was co-authored by C. B. Johnson, Rockwell Mfg. Co., Pittsburgh. The work principally was conerned with valves, and investigation indicated that a single radiograph of valves up to 4-in. size through the seat section permitted elimination of those which might prove faulty in service. With larger valves two radiographs were taken at different angles through the same section.

Worthington Pump & Machinery Corp., Harrison, N. J., has appointed Friel-Detroit Co., 899 Holden Ave., Detroit, distributor to sell and service its line of air compressors there. Ray Friel is owner of the company, John Peebles, sales manager, Ray Gier, equipment specialist and Mary Vizza, office manager.

DIAMETER OF PIPES FOR TRANSMITTING BLAST FROM BLOWER TO CUPOLA

The friction varies as the square of the velocity and inversely as the diameter of the pipe, and therefore, if the diameter of the pipe is doubled the friction loss is divided by 32 provided, of course, the same volume is carried.

The advisability of using a large pipe for conveying the air is shown by the following table which gives the size of pipe which should be used for pressure losses not exceeding one-fourth and one-half ounce per square inch, for various lengths of pipe.

Table of diameters of cupola blast pipes for lengths of 20 to 140 feet, and losses of one-fourth and one-half ounce pressure per square inch

DIAMETERS OF BLAST PIPES

Tons of Iron per Hour	Inside Dia. of Cupola Inches	Cubic Ft of Air per Minute	Length of Pipe in Feet													
			20		40		60		80		100		120		140	
			Diameter of Pipe with Drop of													
			¼ oz.	½ oz.	¼ oz.	½ oz.	¼ oz.	½ oz.	¼ oz.	½ oz.	¼ oz.	½ oz.	¼ oz.	½ oz.	¼ oz.	½ oz.
1	23	500	6	5	7	6	7	6	8	7	9	8	9	8	9	8
2	27	1,000	8	7	9	8	10	9	11	9	11	10	12	11	12	11
3	30	1,500	10	8	11	10	11	10	12	11	13	11	13	12	14	12
4	32	2,000	11	9	12	11	13	12	14	12	15	13	15	14	16	14
5	36	2,500	12	10	14	12	15	13	15	14	16	14	17	15	17	15
6	39	3,000	13	11	15	13	16	14	17	15	18	15	18	16	18	16
7	42	3,500	13	12	15	13	17	15	17	15	18	16	19	17	20	18
8	45	4,000	15	12	16	15	18	15	18	16	19	17	20	18	21	18
9	48	4,500	15	13	17	15	18	16	19	17	20	18	21	19	22	19
10	54	5,000	15	13	18	15	19	17	20	18	21	18	22	19	23	20
11	54	5,500	16	14	18	16	20	17	21	18	22	19	23	20	23	20
12	60	6,000	17	14	19	17	20	17	21	19	22	20	23	21	24	21
13	60	6,500	17	14	19	17	21	18	23	19	23	20	24	21	25	22
14	60	7,000	18	15	20	18	22	19	23	20	24	21	25	22	26	23
15	66	7,500	18	16	21	18	22	19	24	21	25	22	26	22	27	23
16	66	8,000	18	16	22	18	23	20	24	22	26	22	26	23	27	24
17	66	8,500	18	16	22	18	23	20	24	22	26	22	27	24	28	24
18	72	9,000	18	17	22	18	24	21	25	22	27	23	27	24	28	25
19	72	9,500	20	17	23	20	24	22	26	23	28	23	28	25	29	26
20	72	10,000	20	18	23	20	25	22	27	23	28	24	29	25	30	26
21	78	10,500	21	18	24	21	26	23	27	23	29	25	30	26	30	26
22	78	11,000	21	18	24	21	27	23	28	24	29	26	30	27	31	27
23	78	11,500	21	19	25	21	27	24	28	25	30	26	30	27	31	27
24	84	12,000	22	19	25	22	28	24	28	25	31	26	31	27	32	28
25	84	12,500	22	19	26	22	28	24	29	26	31	27	32	28	33	28
26	84	13,000	22	19	26	22	28	24	29	26	31	27	32	28	33	28
27	90	13,500	23	20	26	23	28	24	30	26	31	27	32	28	34	28
28	90	14,000	23	20	27	23	29	25	30	27	32	28	33	29	34	29
29	90	14,500	23	20	27	23	29	26	31	27	32	28	33	29	34	30
30	90	15,000	24	21	27	24	29	26	31	27	32	28	34	30	35	30

The minimum radius of each turn should be equal to the diameter of the pipe. For each turn thus made add three feet in length, when using this table. If the turns are of less radius, the length added should be increased proportionately.

Diameters of pipe for lengths from 30 to 300 feet with blower outlets varying from 3 to 24 inches

Length of pipe, feet	30	60	90	120	150	180	210	240	270	300
Diameter of blower outlet, inches	Diameter of pipe, inches									
3	3¼	3⅝	4	4¼	4½	4¾	5	5⅛	5⅜	5½
3½	3¾	4⅛	4½	4⅞	5	5¼	5½	5⅝	5⅝	6⅛
4	4⅜	4¾	5⅛	5⅜	5¾	6	6¼	6½	6¾	7
4½	5	5⅜	5¾	6	6⅜	6⅜	7	7¼	7½	7⅞
5	5½	6	6⅜	6¾	7⅛	7½	7¾	8⅛	8⅜	8¾
6	6½	7	7⅝	8	8½	9	9⅜	9¾	10⅛	10½
7	7⅝	8¼	8⅞	9⅜	10	10⅜	10⅞	11⅞	11¾	12⅛
8	8¾	9½	10⅛	10¾	11⅜	11⅞	12⅜	12⅜	13⅜	13⅞
9	10	10¾	11½	12⅛	12¾	13⅜	14	14½	15⅛	15⅝
10	11	11⅞	12¾	13½	14¼	14⅞	15½	16⅛	16¾	17⅜
11	12	13	13⅞	14¾	15⅝	16⅜	17⅛	17¾	18½	19⅛
12	13⅛	14¼	15¼	16⅛	17	17⅞	18⅝	19⅜	20⅛	20⅞
13	14¼	15⅜	16½	17½	18⅜	19¼	20⅛	21	21¾	22⅝
14	15⅜	16⅝	17¾	18⅞	19¾	20¾	21¾	22⅝	23½	24¼
15	16½	17¾	19	20⅛	21¼	22¼	23¼	24¼	25⅛	26
16	17½	19	20⅜	21½	22⅝	23¾	24¾	25⅞	26⅞	27¾
17	17⅝	20⅛	21½	22¾	24	25¼	26⅜	27½	28½	29½
18	19¾	21⅜	22¾	24¼	25½	26¾	27⅞	29⅛	30⅛	31¼
19	20⅞	22½	24	25½	27	28¼	29½	30¾	31⅞	33
20	22	23⅝	25⅜	27⅞	28⅜	29¾	31	32¼	33½	34¾
21	23	24⅞	26⅝	28¼	29¾	31⅛	32½	33⅞	35¼	36⅜
22	24⅛	26⅛	27⅞	29½	31⅛	32⅝	34⅛	35½	36⅞	38⅛
23	25¼	27¼	29⅛	30⅞	32½	34⅛	35⅝	37⅛	38½	39⅞
24	26½	28½	30⅜	32¼	34	35⅝	37¼	38¾	40¼	41⅝
Length of Mouthpiece, inches	9	15	21	27	33	39	42	48	54	60

TABLE OF AIR PRESSURE THROUGH PIPES

This table gives directly the pressure needed to transmit a given quantity of air through a pipe 100 feet long and solves the formula:

$$p^1 = \frac{Lv^2}{2500d} \text{ or } p^1 = L\left[\frac{\text{cu. ft.} \times 144}{60 \times d^2 \times 0.7854}\right]^2 \frac{}{25000d}$$

making L = 100 feet.
and q = Cubic feet per minute.
p^1 = Ounces per square inch.
d = Diameter pipe in inches.

$$q = 5.176\ d\ \sqrt{p^1.}$$

For any other length not exceeding 2000 feet, multiply loss by the number of hundred feet of length.

Add for elbows, as follows:

No. pipe diameters in elbow radius	5	3	2	1½	1¼	1	¾	½
Equivalent feet of straight pipe	7.8	8.4	9	10.3	12.7	7.5	35	121

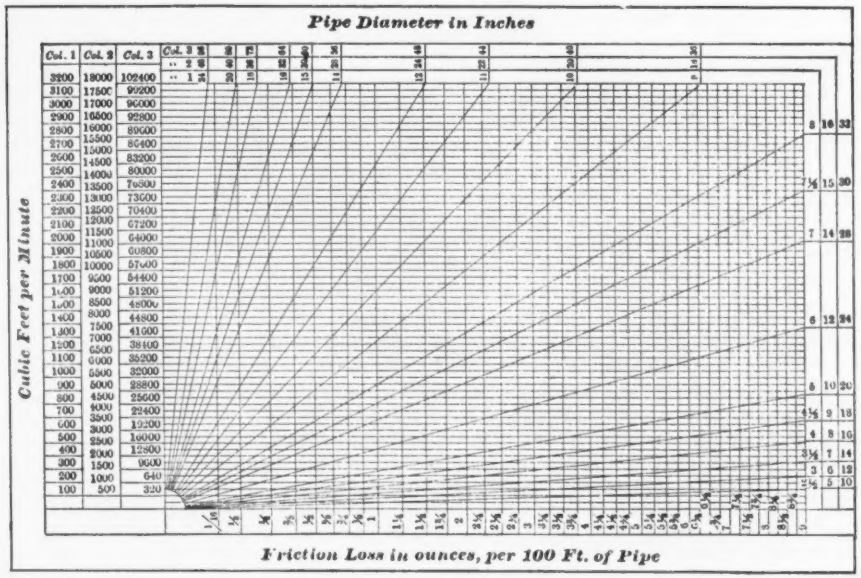


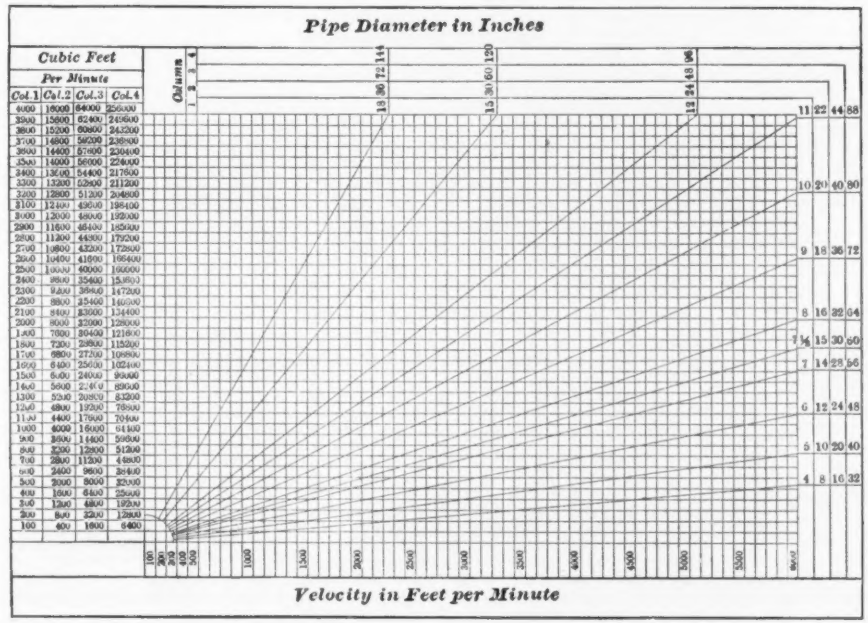
TABLE OF AIR VELOCITY THROUGH PIPES

This table is used for figuring the lineal velocity of air through a pipe when the cubic feet per minute and diameter of pipe are known, or finding any of the factors when the other two are known.

The table solves the formula, velocity in feet per minute = Cu. ft. per minute / Area pipe in sq. ft.

Blower pipes are usually proportioned for a velocity of 3000 feet per minute.

For handling material by air in pipe, the velocity should be between 4000 and 6000 feet per minute, according to the size of the pipe and the density of the material.



How To Get Easier Parting, Smoother Castings, Less Smoke

Use **"dag"** colloidal graphite dispersions to coat chills, molds, patterns, cores, push pins, shoulder screws, flask pins . . . even to coat ladle interiors.

An application of colloidal graphite will produce an unusually slippery dry film because of its peculiar arrangement of atoms. It is virtually unaffected by heat . . . . up to 5000° F. in inert atmospheres . . . and is so thin that critical casting tolerances are not affected at all.

Patterns, dies, and molds treated with **"dag"** colloidal graphite give superior reproduction and smoother casting surfaces. Less finishing is required; rejects are fewer; mold life is lengthened.

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MICHIGAN FOUNDRY CONFERENCE

Studies Air Pollution Problems

By EDWIN BREMER
Metallurgical Editor
FOUNDRY

WHILE inclement weather made serious inroads on expected attendance, it did not congeal the interest of those present at the annual Michigan Foundry Conference held Nov. 10-11 at Michigan State College, East Lansing, Mich. Meeting was sponsored by the Department of Mechanical Engineering of the college in co-operation with the Detroit, Michiana, Saginaw Valley and Western Michigan chapters of the American Foundrymen's Society.

At the opening session, under the direction of Jess Toth, Harry W. Dietert Co., Detroit, Prof. Charles C. Sigerfoos introduced Prof. L. C. Price, who welcomed those attending the conference. He pointed out that such meetings bring the students closer to the foundry industry, with a resultant enlightened change of viewpoint toward it. He also mentioned that activities of the Foundry Educational Foundation brought the student still closer to the industry. Dr. Lorin G. Miller, dean of the School of Engineering, spoke briefly, and remarked that the conference not only would aid in solving problems, but also permit broadening of contact among foundry personnel.

Ben D. Claffey, Acme Aluminum Alloys Inc., Dayton, O., presented a discussion on "Trends in Foundry Education." Educational work, he said, should be established at three levels to attract youth to the industry and provide instructions to prepare them for the field of endeavor they wish to follow. One of the levels is the high school; another is the trade or vocational school, and the third the college and university. He said that in the high school and trade school, the programs are usually as effective as the amount of interest displayed in them by the local foundry owners and operators. To establish foundry training courses in such schools it is necessary for foundry operators to work with the school boards. After establishment the operators should continue to co-operate by sending men to speak or lecture on the industry, arrange plant visitations, and then see that the interested graduates are given jobs.

Mr. Claffey then briefly discussed the activities of the Foundry Educational Foundation which was founded in 1947 to develop a training program in conjunction with colleges and universities. In 1948 six schools were participating, and at present there are twelve.

Sam F. Carter, American Cast Iron Pipe Co., Birmingham, described "Basic Cupola Operation and Practice." He said that while most of the data obtained was developed on a 20-in. diam cupola, his firm now is carrying on the investigation with a 42-in. cupola operated on a commercial basis. Basic cupola is lined with magnesite brick, and requires better supervision in operation than in case of the ordinary acid-lined cupola. The basic slag chills more rapidly than regular acid slag, and to eliminate any stoppage at the slaghole the cupola must be operated constantly at a high temperature to maintain the slag in a fluid condition.

In basic operation the silicon loss is considerably greater than with acid linings, and carbon pickup is about double. Since a basic slag is employed there is a marked decrease in sulphur content. For example, with two heats of approximately the same composition melted with acid and basic linings, the former showed a pickup of 0.74 per cent C and a final S of 0.085 per cent while the basic melt picked up 1.87 per cent C, and had a final S of 0.051 per cent. In those heats the burn-back of the cupola lining at the melting zone was 2.4 in. with the basic lining and 6.9 in. with the acid lining.

Favor Acid Lined Cupola

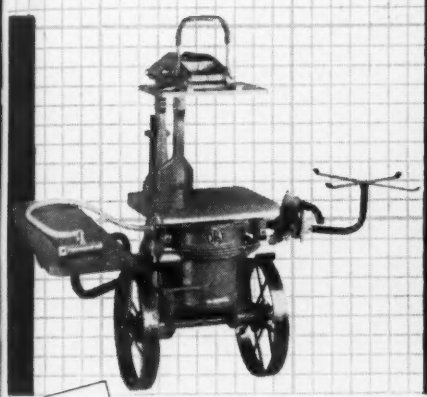
Mr. Carter said that he doubted that the basic-lined cupola would supplant the acid-lined unit, due primarily to higher refractory cost, but rather it would be employed for special applications. For example, where deterioration of raw material supply made it impossible to obtain satisfactory iron with acid linings, and in producing low-sulphur iron for treating with magnesium to make nodular cast iron. Also, since the basic-lined cupola can be used to obtain a reduction in phosphorus content, it might be employed to produce castings of low phosphorus content from high-phosphorous pig iron and scrap. However, when operated for reduction of phosphorus, there is little if any change in sulphur content of the resulting iron.

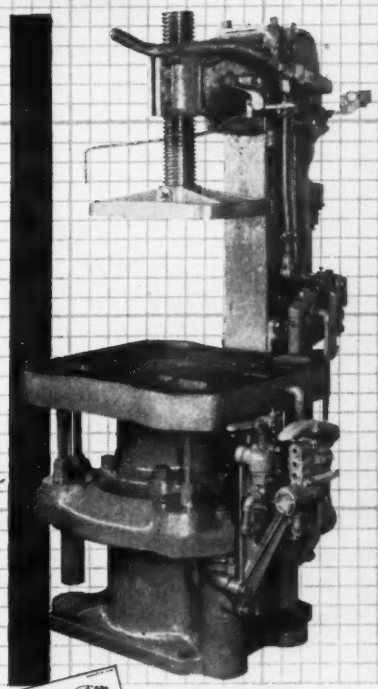
At the afternoon session, with J. F. Secor, Hill & Griffith Co., Cincinnati, presiding, a panel discussion on "Foundry Air Pollution" was held. Thaddeus Giszczak, American Foundrymen's Society, Detroit, acted as co-ordinator, and different phases of the subject were covered by various speakers. A. H. Eichmeier, U. S. Weather Bu-

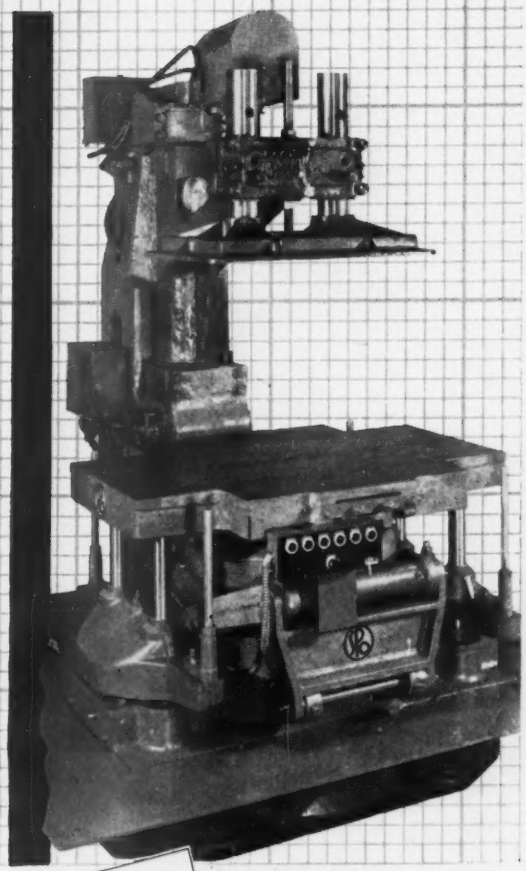
(*Continued on page* 164)

Speakers at the air pollution session at the Michigan conference included, left to right: J. F. Secor, Hill & Griffith Co., Cincinnati; J. M. Kane, American Air Filter Co., Louisville; George Tubich, Michigan Department of Health, Grand Rapids, Mich.; Thaddeus Giszczak, Detroit; K. E. Robinson, Michigan Department of Health, Lansing, Mich.; A. H. Eichmeier, U. S. Weather Bureau, Lansing, Mich., and Prof. Forrest Strong, Michigan State College

SPO
MOLDING MACHINES







Jolt-squeeze machines (eight models) are described and illustrated in SPO Series No. 100 catalog. Post machines with swing heads and cantilever type squeezers are shown with complete specifications.

Eight models of MILWAUKEE Jolt-Squeeze-Pin Strippers are described in detail in Bulletin No. 110-A. Construction features, operating data, and production capacities are charted for reference.

Push-button operated jolt-squeeze-strip machines are described in SPO Series No. 200 catalog. Design features, automatic push-button type control, and production capacities are covered in detail.

Scaled to Production Needs!

Designed by experienced foundrymen, these SPO machines are available in a wide range of sizes and models to meet all foundry molding requirements. Simplified control, safe operation, and precision accuracy are built-in features which assure the production of copes and drags of uniform standard.

Both portable and stationary types of SPO molding machines can be furnished to meet individual production needs, and they range from small, compact, manually-operated jolt-squeeze units to fully automatic jolt-squeeze-strip machines featuring push-button control.

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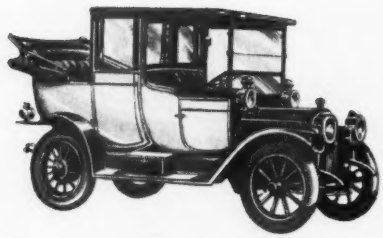

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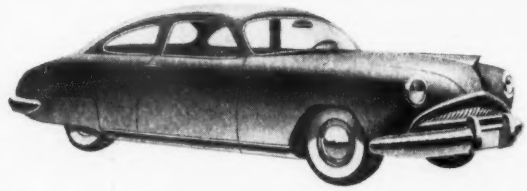

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The Speedmullor is a result of the same type of progressive engineering development applied to the foundry machinery industry. The Speedmullor embodies a new principle of mulling and is capable of utilizing higher speed and power and producing foundry sands mulled to their *maximum attainable* physical properties with the lowest material cost, the lowest power cost and the lowest operating and maintenance cost per ton.

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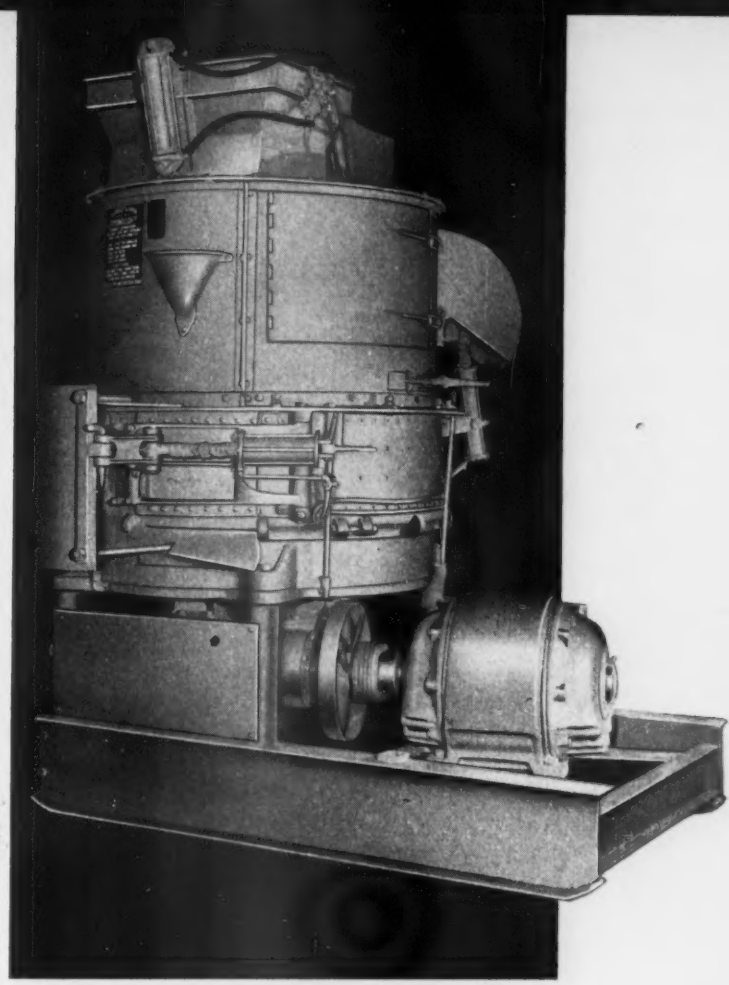
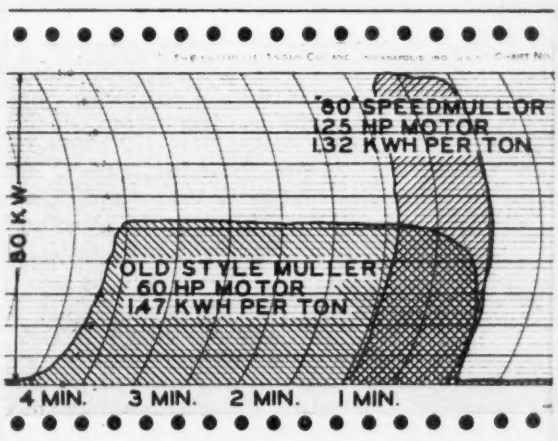
THE MODERN, HIGH POWER, LOW COST METHOD OF MULLING

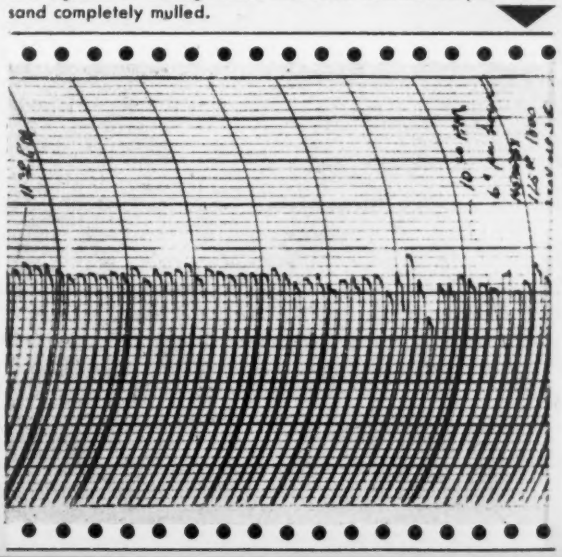
Like other modern machines, the high powered Speedmullor accomplishes a far better job in less time . . . and at lower cost. With lightweight moving parts, the Speedmullor utilizes centrifugal force to mull sand faster and more thoroughly than any old style muller. The rubber tired mulling wheels of the Speedmullor transmit twice the mulling pressure and cover three times as much mulling area as the heavy, slow-rolling vertical wheels of the latest design of old style muller.





Typical are the results of recent tests run on a Speedmullor and an old style muller of the latest design, both preparing the *same* sand in the *same* sand system. The Speedmullor, utilizing higher horsepower for a far shorter period of time, consumed 1.32 K.W.H. per ton of sand mulled to maximum physical properties. The old style muller, utilizing lower horsepower for a far longer period of time, consumed 1.47 K.W.H. per ton of sand mulled to approximately equal properties.

A typical watt-hour meter record of operation of a manually controlled Model "80" Speedmullor during a period of operation of exactly one hour. Fifty batches were uniformly and thoroughly mulled . . . over 1150 cu. ft. of sand mulled to ultimate physical properties in one hour. The Speedmullor's high capacity and its thoroughness of mulling assure the lowest overall cost per ton of sand completely mulled.



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70 TONS PER HOUR—

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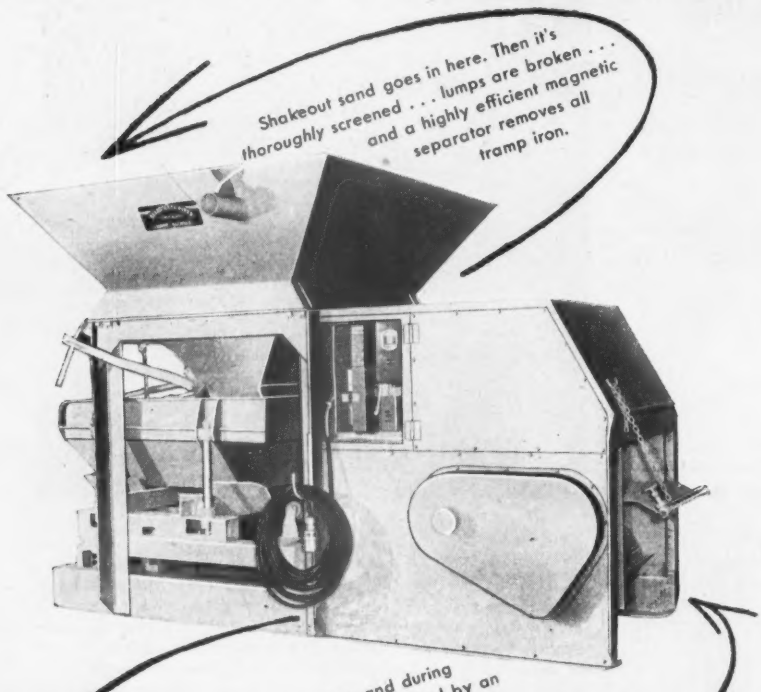
Shakeout sand goes in here. Then it's thoroughly screened . . . lumps are broken . . . and a highly efficient magnetic separator removes all tramp iron.
Sand is doubly aerated—before and during discharge—and moisture is added by an adjustable water spray. Up to 70 tons of sand are completely conditioned per hour!

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Reduce your costs, produce more per molder, and *improve* sand and casting quality with *complete* sand conditioning! The Preparator—efficient, heavy duty, portable—thoroughly conditions up to 70 tons of molding sand per hour. It's built to take the roughest treatment, and all operating mechanism is protected by dust-tight enclosures. Both large and small foundries throughout the world use Preparators . . . let us demonstrate the outstanding Preparator features to you in a neighboring foundry . . . write today!

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MEMBER FEMA

(*Continued from page* 160)

reau, East Lansing, Mich., spoke on meteorological conditions, and stated that air movements play an important part in considering air pollution as they carry particulate matter away and distribute it over a wide territory. Troubles occur when stagnant conditions exist since the pollution then is confined to a restricted area.

Prof. Forrest Strong, Michigan State College, described the effect of sulphur and fluorine gases on plant life stating that while less than three parts per million of SO_2 cannot be detected by humans, rose bushes are susceptible to 2 to 4 parts and beeches 2 parts per million — the leaves turning reddish brown. Gladioli are quite susceptible to very small amounts of fluorine. However, certain parasitic and virus diseases in plants give similar indications so one should not jump to the conclusion that leaf browning, bleaching, etc. is caused by air pollution.

Detect Air Pollution

K. E. Robinson, Michigan Department of Health, Lansing, Mich., spoke on air pollution with respect to public health, and mentioned that chief concern is not with the coarse particulate matter 10 micron (1/40-in.) in size which precipitates rather easily, but in the finer sizes which remain in suspension in the air, and can build up to considerable concentrations. George Tubich, Michigan Department of Health, Grand Rapids, Mich., described various types of instruments used to determine atmospheric pollution.

J. M. Kane, American Air Filter Co., Louisville, Ky., spoke on equipment for dust control and stated that it is comparatively simple to remove coarse material down to 10 micron size. Below that size material can be removed efficiently at reasonable cost when the temperature is under 200° F. However, when the temperature is higher, difficulty is encountered. He said that costs of various types of equipment vary from 15 cents to $1.50 a cu ft of air handled—dry centrifugal type, 15 to 25 cents; fabric and wet type, 25 to 40 cents, and electrostatic and ultrasonic, $1 to $1.50.

In closing the session Thaddeus Giszczak pointed out that ordinances relating to air pollution vary from community to community, and that foundrymen should familiarize themselves with those of their cities, and endeavor to comply with them. He also said that closer attention to cupola operation would eliminate complaints on smoke and dust. For example, keep sprues and other foundry returns free from sand to stop

discharge of that material from the stacks; also, avoid dropping the charges from great heights which tends to break up coke into fine particles which are carried out to the stack by the air blast.

Final session held Saturday morning with Stanley Davis, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., as chairman, comprised the presentation of two motion pictures on gating, and a brief report on foundry metallurgical research at Michigan State. First motion picture was the recently completed AFS research study of fluid flow in transparent molds. In color, the picture showed further investigation on relationships between sprue, runner and gates, and quality of aluminum alloy castings. It indicated that best results were obtained when the cross-sectional areas of sprue, runner and gates were in the ratio of 1:4:4 that the sprue base should be enlarged, and the runner restricted on each side of the sprue base; avoid abrupt changes in flow channel areas and sharp corners; use the smallest possible sprue and fill it quickly, and hold the crucible or ladle lip as close to the sprue opening as possible when pouring.

Inoculated Gray Iron

H. L. Womochel, Michigan State College, spoke briefly on research progress at the school with respect to inoculation of gray iron. Indications were that calcium-silicon is quite effective, and that additions to provide silicon pickup of 0.6 per cent give an appreciable increase in properties as compared to 0.3 per cent. Use of 1 per cent silico-manganese was found to decrease transverse strength with a slight increase in chill. Mr. Womochel mentioned that there is a significant difference in effects of commercial inoculants; this should be considered in changing from one to another.

Second colored motion picture, "Finger Gating," was presented by W. H. Johnson, Naval Research Laboratory, Washington, and showed that uniform flow could be obtained in finger gates when the total finger area is greater than the sprue area. This is accomplished by using gates which absorb the momentum of the stream by bending the runner away from the casting, by using a tapered runner, by designing the runner so that the molten metal impinged on itself, and by using pools. Pools are located on both sides of the sprue as enlargements of the runner, or as a single enlarged cavity on one side of the sprue. Pools may be in the drag and cope or only in the drag.

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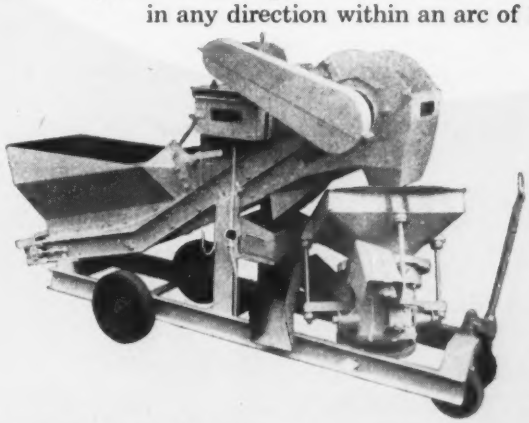
The new Junior Nite-Gang, a portable sand conditioner for the small or medium size foundry, economically produces up to 40 tons of *completely* conditioned sand per hour! The Junior Nite-Gang is easily moved to any floor in the foundry. Shakeout sand and new sand or bonding additions are loaded directly into its hopper by front end loader, crane bucket or other means. This sand is carried by a cleated conveyor belt through an adjustable feed gate and discharged over a magnetic separator. The blended, iron free sand falls onto the high capacity Screenarator which completely screens, aerates and discharges it into bin, pile or windrow. The swivel-mounted Screenarator with adjustable discharge chute permits discharge to any distance within fifty feet and in any direction within an arc of 180 degrees.



Use the Junior Nite-Gang for complete sand conditioning . . . blending, magnetic separation, screening and aeration! Eliminate laborious hand shoveling and other manual operations! Bulletin No. 1125 fully describes the new Junior Nite-Gang and is available on request.

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Chicago Foundrymen Plan Practice Course

"Scrap the Scrap Pile" is the intriguing title for the 1951 Practice and Demonstration course which Chicago Chapter, American Foundrymen's Society, will initiate Jan. 8 and continue on six succeeding second and fourth Monday nights through April 9. Meeting place will be the auditorium of Peoples' Gas Light & Power Co., 122 S. Michigan Ave., and 7:30 p.m. the hour.

Specific topics and dates are as follows: "Better Quality Control Through the Laboratory"—Jan. 8; "Modern Molding Methods"—Jan. 22; "Modern Coremaking Methods"—Feb. 12; "Improved Foundry Safety"—Feb. 26; "New Methods of Gating"—March 12; "Defective Castings and What To Do About Them"—March 26; and a "bonus" meeting—Apr. 9.

Harold G. Haines, metallurgist, Howard Foundry Co., is chairman of the committee arranging and presenting the course. Other committee members are John Dix, instructor, Austin High School; Edwin H. Pritchard, salesman, Western Materials Co.; Albert P. Di Girolamo, general foreman, Chicago Steel Foundry Co.; Roy W. Schroeder, assistant professor, foundry laboratory, Navy Pier Branch, University of Illinois; Cecil F. Seyrau, metallurgist, Illinois Malleable Iron Co.; and A. C. Erlandson, foundry superintendent, Pettibone Mulliken Corp.

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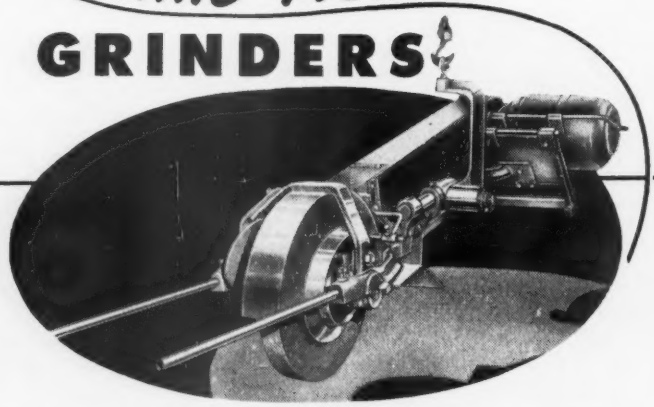

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Cupola Operation Is Topic at Educational Course

Fourth educational program, sponsored by Philadelphia Chapter of the AFS, Oct. 11-13, was concerned primarily with cupola operations. Held at the Engineering building of the University of Pennsylvania, the 2½-day course drew 66 people from a 300-mile radius, representing management, production men, mechanics in supervisory training, and apprentice molders.

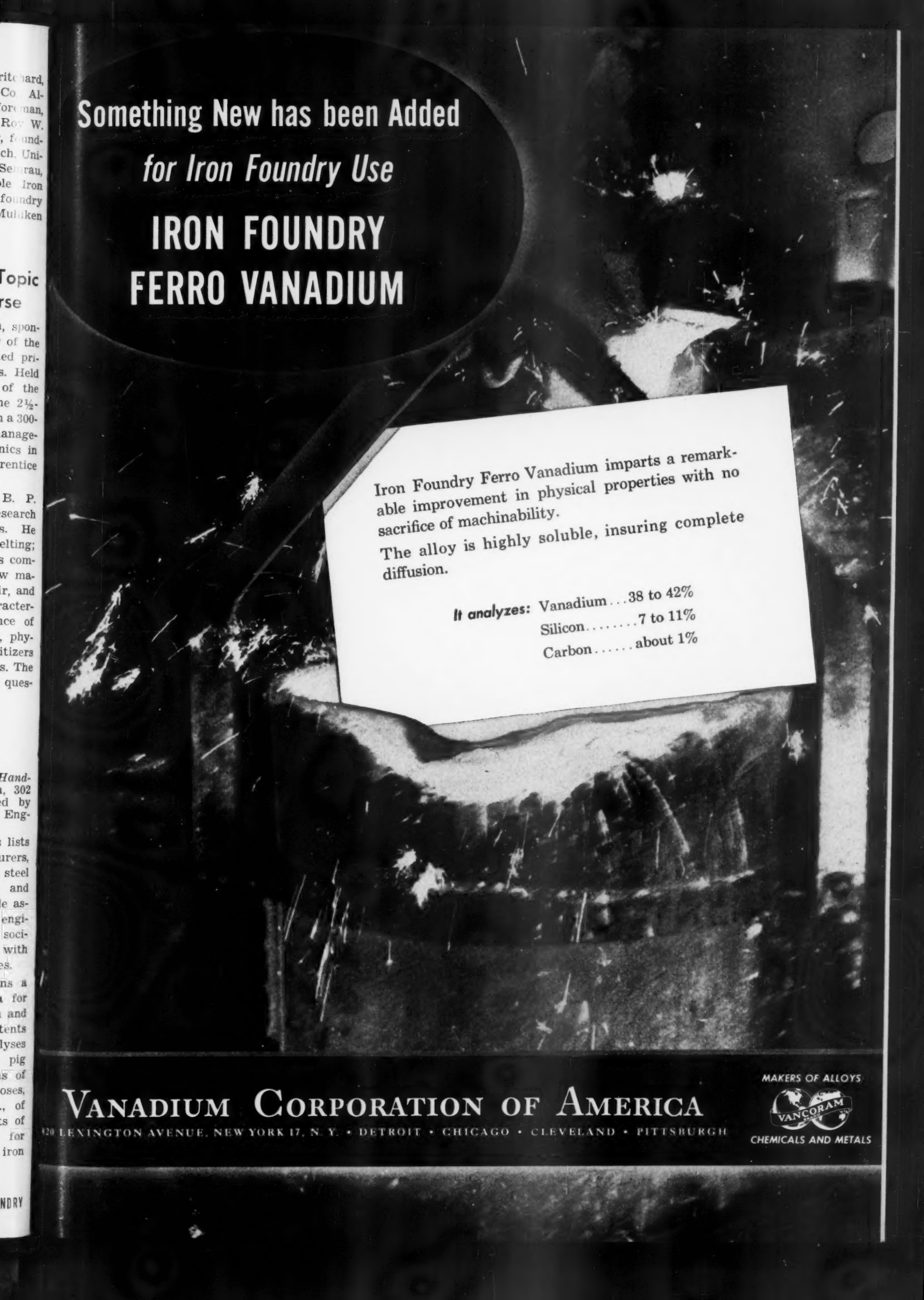
The course lecturer was B. P. Mulcahy, president, Fuel Research Laboratory Inc., Indianapolis. He covered: A review of cupola melting; discussion of the cupola and its components; cupola equipment; raw material including metals, coke, air, and fluxes; discussion of metal characteristics, including the significance of temperature, chemical analysis, physical properties, use of graphitizers and deoxidants and use of alloys. The final session was devoted to questions and answers.

Book Review

Iron & Steel Directory and Handbook—1950, sixth edition, cloth, 302 pages, 8½ x 5½-in. Published by Louis Cassier Co. Ltd., London, England.

The directory section includes lists of British pig iron manufacturers, iron founders, steel works, steel founders and British and iron and steel groups. Iron and steel trade associations and iron, steel and engineering scientific and technical societies and institutions are listed with addresses and names of secretaries.

The handbook section contains a large amount of technical data for engineers, metallurgists and iron and steel makers and users. The contents include a list of approximate analyses of different grades of British pig irons, recommended compositions of nickel cast iron for various purposes, tables relating to weights, etc., of cast iron and steel and abstracts of British Standard specifications for ferrous materials, including cast iron and cast steels.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PURDUE CASTING CONFERENCE

Covers Production and Graduate Student Problems

By FRANK G. STEINEBACH
Editor
FOUNDRY

PROGRAM of the well attended third annual Metals Casting Conference held at Purdue University, Lafayette, Ind., Nov. 2-3, combined discussions of pertinent foundry production problems with consideration of the place of the engineering graduate in the foundry field.

The conference was sponsored by the Department of General Engineering, School of Chemical and Metallurgical Engineering, Technical Extension Division of Purdue University, and the Michiana and Central Indiana Chapters of the American Foundrymen's Society.

L. L. Andrus, American Wheelabrator & Equipment Corp., Mishawaka, Ind., and chairman of the conference committee, opened the meeting by congratulating the foundrymen who had returned to the university to take another lesson in developments affecting their industry. Henry Abbott, purchasing agent, Purdue, welcomed the conference to the campus, and outlined the need of all universities for moral support and material aid from industry.

Stowell C. Wasson, National Malleable & Steel Castings Co., Chicago, and chairman of the Foundry Educational Foundation, speaking on the subject "Industry Must Look to the University," pointed to the changes within the foundry industry the last 25 or 30 years in connection with supervisors. The practice of promoting men from the ranks to foremanship without any specific training beyond experience to do a good job at the bench gradually is being supplanted. Personnel departments, time and motion study departments, methods and engineering departments—all employing men trained for specific jobs—have taken many of the duties which fell upon the foreman a quarter-century ago. Also, industry has spent large sums in modernizing and installing new equipment so that the foreman is surrounded by a mass of facilities from which he must get efficient operation.

As the result of these changes, the ordinary foreman feels that his responsibility has declined to a point where he is mainly involved in pushing through production. However, by surrounding the foreman with these specially trained men and modern labor saving equipment, the foreman's responsibility has been increased. In the final analysis, the lowest grade of supervision is management's representative to the workman and management must rely strongly on this line of supervision to do a management selling job. For this reason, industry must look to the universities for trained specialists to occupy these suspervisory positions.

Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, and president of the AFS, discussed the work of the society and its various divisions. He indicated that the AFS is directing considerable attention to the training of boys for the foundry industry in high schools and trade schools, and that it carried developments of the industry to the field through nine regional meetings, 320 chapter meetings and one national meeting the past year. He outlined the proposed work to be done on safety and hygiene and discussed the campaign to raise funds for construction of permanent AFS headquarters.

Prof. H. A. Bolz, head, Department of General Engineering, Purdue, presided at the second session, devoted to recent foundry engineering development. J. J. McClain, chief foundry engineer, Light Alloys Foundry, Fabricast Division, General Motors Corp., Bedford, Ind., described the production of five aluminum castings for the Buick Dynaflow transmission; dielectric curing of cores, and making of patterns and coreboxes by more economical methods.

The Buick transmission castings are poured of aluminum by the Antioch or plaster process. In making the molds, gypsum in the form of calcium sulphate hemihydrate is provided with additions of water, sodium silicate, terra alba, talc asbestos and sand to form a slurry. This is mixed to a definite consistency, poured into molds and coreboxes and allowed to set until sufficient green strength has been built up. The aggregate sets from 2 to 4 hours at room temperature, is then put into an autoclave for 5 to 9 hours, depending on size, at steam pressures of 9 to 17½ psi, the pressure generating a temperature of 250° F. After removal from the autoclave, the molds stand for 12 to 14 hours, are dried 15 to 20 hours at 470° F, and then are assembled and poured.

Mr. McClain discussed curing of synthetic resin cores in the dielectric tunnel, stressing the advantages of

Purdue Conference participants included: Left to right, seated—Edwin W. Horlebein, AFS immediate past president; Walton L. Woody, AFS president; Paul H. Harlan, Electric Steel Castings Co., Indianapolis. Standing—Claude B. Schneible, Claude B. Schneible Co., Detroit; George K. Dreher, executive director, Foundry Educational Foundation, Ceveland

short baking time—measured in minutes or seconds—and the small requirement for storage space. Further investigation of core plates is needed since metal plates rob the core of heat. In most cases, cores with chills and supporting rods can be processed if the rods do not short out the electronic field. It was indicated that there are many unanswered problems in application of dielectric core curing, but possibilities offered by the tool demand further intensive investigation.

The second paper on recent developments was presented by Fred Carl, shop engineer, Ferrous Section, Fabricast Division, General Motors Corp. Mr. Carl discussed three different investigations on the use of oxygen in cupola melting. These studies covered work on 19, 48 and 72-in. cupolas. All three investigations reported favorable increases in melting rates with oxygen additions. With the 19-in. cupola, melting increases up to 40 per cent were attained, but that figure requires very large amounts of oxygen and would be of doubtful economic value. The 72-in. cupola showed no improvement in melting rate with 1 per cent oxygen, but with 2 and 3 per cent, increases up to 20 per cent were possible.

Use of Oxygen Saves Coke

The greatest increase in tapping temperature was with the 19-in. cupola and the least with the 72-in. cupola. This was explained in part by the fairly low temperature level produced by the small unit. In the case of the 72-in. cupola, addition of 1 per cent oxygen saved 7.2 tons of coke in producing 384 tons of iron. No drastic changes in chemistry were reported. Mr. Carl said the three reports seem to indicate that while there are distinct advantages in the use of oxygen enrichment, its universal application to cupolas still is of doubtful economic value.

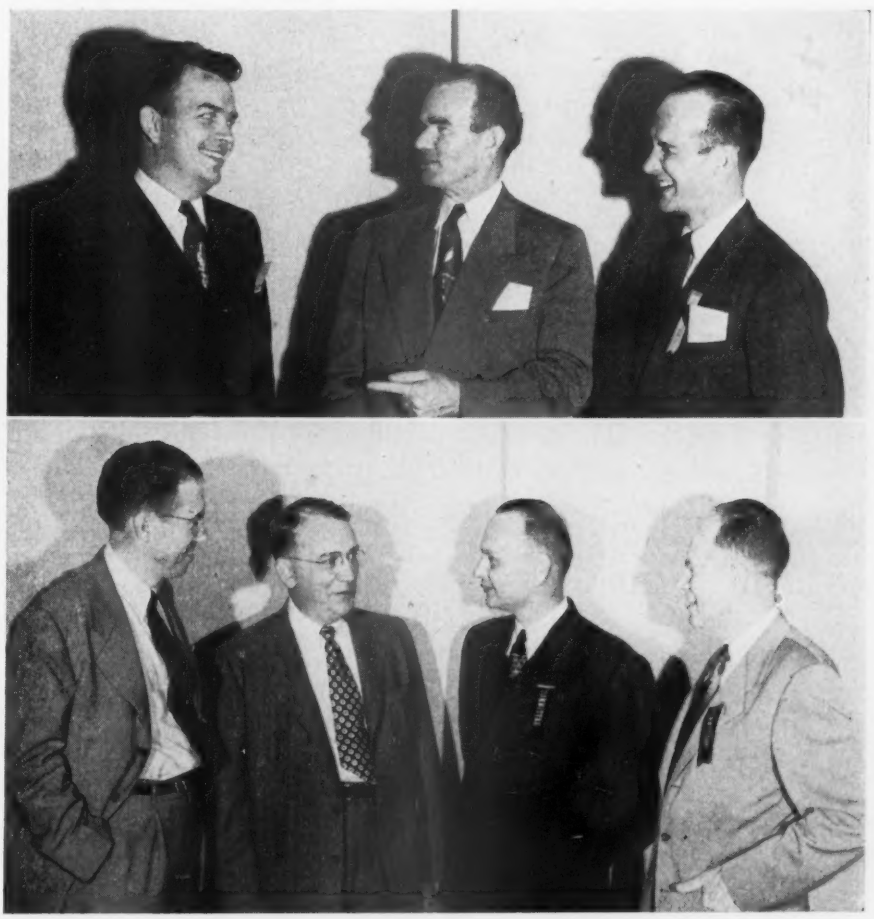
Mr. Carl also discussed the production of castings by the "C" process, and demonstrated the equipment and processes used. He stated that the castings made by the process have a good finish and in some cases do not have to be cleaned after shakeout. Castings are made to an overall tolerance of ± 0.003 in. per in. if required, which is fairly competitive with the tolerances obtained by the lost wax process. It appears that brasses and bronzes, gray iron, nodular iron, malleable iron and possibly steel are the metals that fit best into the process.

William T. Bean Jr., Industrial Electronics Inc., Detroit, gave an interesting and animated discussion on the subject, "Good Casting Design —On Purpose!" As usual, Mr. Bean needled the industry for its lack of aggressiveness in the matter of casting design. Louis Reiff, Superior Steel & Malleable Castings Co., Benton Harbor, Mich., and Prof. G. W. Bergren of Purdue were co-chairmen of the meeting.

"Engineering Graduates in the Small and Medium Foundry" was the subject of an inspirational address by E. W. Horlebein, Gibson & Kirk Co., Baltimore, and immediate past president of the AFS. George K. Dreher, Foundry Educational Foundation, Cleveland, and Paul Harlan, Electric Steel Castings Co., Indianapolis, were co-chairmen of the session. Mr. Horlebein pointed out that while much progress has been made in the foundry industry, something still seems to be missing. It appears that the quality of our knowledge, particularly in the small and medium sized shops, is, in many instances, the element most needed. The technical man, in such instances, is not a luxury but a necessity, for the industry's welfare does not lie in the present but in the future.

Mr. Horlebein paid tribute to the great work of the Foundry Educational Foundation and indicated the value to the industry of the boys who are being given a greater amount of training in the production and use of castings. The engineers who go into the foundry industry provide the nucleus for future supervisory and management personnel. At the same time, the engineering graduates who have had some special foundry training and go into engineering department of companies using castings, will in the long run aid the industry greatly since they will be able to apply the proper type and classification of castings in the construction of engineering materials. The speaker stressed the fact that any act performed by a foundryman for the best interest of the industry at large cannot help ultimately but react in his favor. Therefore, there should be no reluctance among the small and medium size plants in accepting graduates into their organizations.

At the banquet, with William Ferrel, Auto Specialties Mfg. Co., St. Joseph, Mich., presiding, Leroy P. Robinson, Archer-Daniels-Midland



At the Purdue Conference: Above, left to right—Prof. G. W. Bergren, Purdue; William T. Bean Jr., Industrial Electronics Inc., Detroit; Robert Spurgin III, Swayne-Robinson & Co., Richmond, Ind. Below—Prof. H. A. Bolz, Purdue; Frank G. Steinebach, *Foundry*; Profs. C. T. Marek and R. W. Lindley, Purdue

Co., Cleveland, presented an interesting address on "The Love Life of a Pullet or How To Lose Money on a Modern Chicken Farm." "Robbie" was in his usual excellent form.

Allen J. Reid, General Refractories Co., Indianapolis, presided at the first session on Friday where the most recent picture produced by Battelle Memorial Institute for the research project of the Aluminum and Magnesium Division of the AFS and entitled "Fluid Flow in Transparent Molds" was shown. Sil C. Massari, technical director, AFS, Chicago, introduced this presentation. The film, the second to be produced under the Aluminum and Magnesium Division research auspices, portrays a number of gating problems and their solutions by means of lucite molds, using water as the fluid medium. This is an excellent film and should provide the basis for much discussion before the various chapters of the AFS.

Some of the conclusions drawn from the investigation illustrated by the film are as follows: Keep the pouring lip low; fill the sprue quickly; don't pour directly down the sprue; put the entire gate on the pattern; use a tapered sprue; use the smallest sprue possible; restrict the runner on either side of the sprue base; streamline the runner; put the runner in the drag and the gates in the cope; make the runner area four to six times the area of the bottom of the sprue; make the cross-sectional area of the gates equal to the area of the runner; reduce the area of the runner by the area of the gate, as it is passed; avoid abrupt changes in the area of flow channel; avoid sharp corners through the flow channel.

With S. Franklin Swain, Golden Foundry Co., Columbus, Ind., and Robert Spurgin III, Swayne-Robinson Co., Richmond, Ind., presiding, Norman A. Birch, metallurgist, American Brake Shoe Co., Meadville, Pa., discussed "Gating and Risering." Mr. Birch outlined the methods followed by his organization in gating and risering control and emphasized the importance of work. He pointed out that gating and risering means more than just the arrangement of down sprue, runner, in gates and risers. It includes rigging, which is the pattern and flask equipment; takes into consideration and is influenced by the type of machine, the sand, the number of castings, class of help, metal, and state of production schedule. In fact, it takes into account all of the operations which determine whether the customer is going to get a satisfactory casting on time, or the foundry produces another piece of scrap.

Control of gating and risering is a simple matter of keeping records, the method being adapted to the particular shop conditions. Mr. Birch suggested that one man be assigned to supervise gating and risering practices. A card file system which perpetuates the records is most valuable. Molding foremen and molders must be educated to rely on and use this card file system.

Castings display at the Purdue Metals Casting Conference. The exhibit of castings and plant views was sponsored by Foundry Educational Foundation members belonging to the Michiana and Central Indiana Chapters, AFS, and was arranged by Vernon S. Spears, American Wheelabrator & Equipment Corp.

Discuss Foundry Sand

At the last technical session, R. P. Schauss, Illinois Clay Products Co., Chicago, discussed "Fundamentals of Foundry Sand" with Prof. C. T. Marek, Purdue, and Robert Greenlee, Auto Specialties Mfg. Co., presiding. Mr. Schauss described the properties given to molding sand by the various individual materials used in the mixture. He indicated what properties—including green strength, dry strength, flowability, and surface drying characteristics—may be expected from western bentonite, southern bentonite, kaolin or fireclay, and illite type clays. He stressed the point that much new thinking in the sand field is evident and prophesied that industry will hear a lot more on the value of molding sand density. He pointed out that research has shown that pressures in the mold at time of pouring are not as high as previously believed.

At the opening session on Friday conference visitors were treated with an inspirational talk by A. A. Potter, dean of engineering at Purdue. The dean paid tribute to the foundry industry as one of the largest and one of the most important in providing our national security. But he stated that all of our engineering progress is less important than finding out what causes wars and how to prevent them. We must learn more about human beings and what makes Uncle Joe act the way he does.

Dean Potter stated that this na-

(*Concluded on page* 172)

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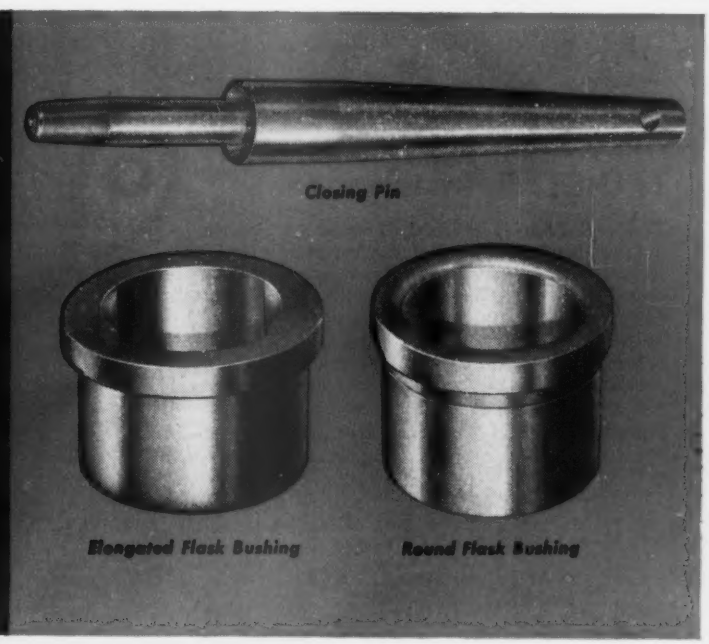
Universal Flask Pins and Bushings save precious minutes by assuring instant, accurate alignment of cope and drag. Since they are heat-treated and precision ground from high quality steel to stand up under rough treatment, Universal Flask Pins and Bushings also save the cost and down-time that replacement always requires. Cope Bushings are quickly guided to Drag Pins over tapered, loose-fitting Closing Pins which are easily removed after assembly. The special elongated Flask Bushing is designed to permit longitudinal expansion to compensate for metal heat *without affecting accurate alignment.* Standard sizes are carried in stock — special sizes and types to order. Direct your inquiries and orders to the office nearest you — 1060 Broad St., Newark, N. J., and 5035 Sixth Ave., Kenosha, Wisconsin — or write to our home office.



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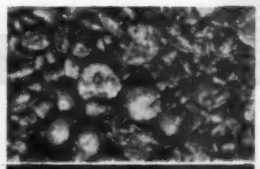
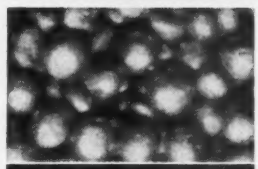


CHILLED IRON No. 230 at Mag 10X (after 50 passes)



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AMERICAN WHEELABRATOR & EQUIPMENT CORP., 505 S. Byrkit St., Mishawaka 2, Ind.

(*Concluded from page* 170)

tion must help to prevent starvation, not by sending millions of dollars to foreign fields, but by teaching other countries how to do a better job of farming. We must learn what causes people to become frustrated, what causes people to strike. It would seem in looking about the world of conflict that we know absolutely nothing about men. We are only scratching the surface in methods of handling industrial relations. Our immediate need is not scientific, not engineering, but is social, ethical and, in a sense, spiritual. Dean Potter believes that because we have not found the answers to these problems of the human mind, we must live in an armed camp for many years. He questioned whether we are wise enough to have guns and butter, or to have both military preparedness and civilian progress.

Interesting Casting Display

During the entire week in which the conference was held, the contributing members of the Foundry Educational Foundation belonging to the Michiana and Central Indiana Chapters of the AFS maintained an interesting casting display in the Purdue Memorial Union. This display was visited by a large number of students during the week and it is believed interested many in the importance of cast products as engineering materials. The display was arranged by V. S. Spears, American Wheelabrator & Equipment Corp., Mishawaka, and included these companies:

American Wheelabrator & Equipment Corp., Mishawaka; Electric Steel Castings Co., Indianapolis; Dalton Foundries Inc., Warsaw, Ind.; Sterling Brass Foundry, Elkart, Ind.; Decatur Casting Co., Decatur, Ind.; Chicago Hardware Foundry Co., Elkhart Division, Elkhart; Delco-Remy Division, General Motors Corp., Anderson, Ind.; National Malleable & Steel Castings Co., Indianapolis; Auto Specialties Mfg. Co., St. Joseph, Mich.; Sibley Machine & Foundry Corp., South Bend, Ind.; Golden Foundry Co., Columbus, Ind; Nonferrous Foundries Inc., Indianapolis; Link-Belt Co., Indianapolis; Overmyer Mould Co., Foundry Division, Winchester, Ind.; Langsenkamp-Wheeler Brass Works Inc., Indianapolis; R. W. G. Foundry Co., Anderson, Ind.; Fabricast Division, General Motors Corp., Bedford, Ind.; Fountain Foundry Co., Columbus, Ind.; La Porte Foundry Co. Inc., La Porte, Ind.; Swayne, Robinson & Co., Richmond, Ind.; Hoosier Iron Works Inc., Kokomo, Ind.

Lavin Marks 50th Year

R. Lavin & Sons Inc., Chicago, recently published the fiftieth anniversary issue of its house organ, "The Lavingot." The issue contains photo reproductions of company officers and departmental personnel and brief comment on the company's organization, policies, and research, development, and engineering activities.

Two large charts provide extensive data on brass, bronze, nickel silver, aluminum and zinc casting alloys. Other sections, some well illustrated, discuss deoxidizers, degasifiers and fluxes; test bar designs; defects in nonferrous castings, and suggestions on foundry practice.

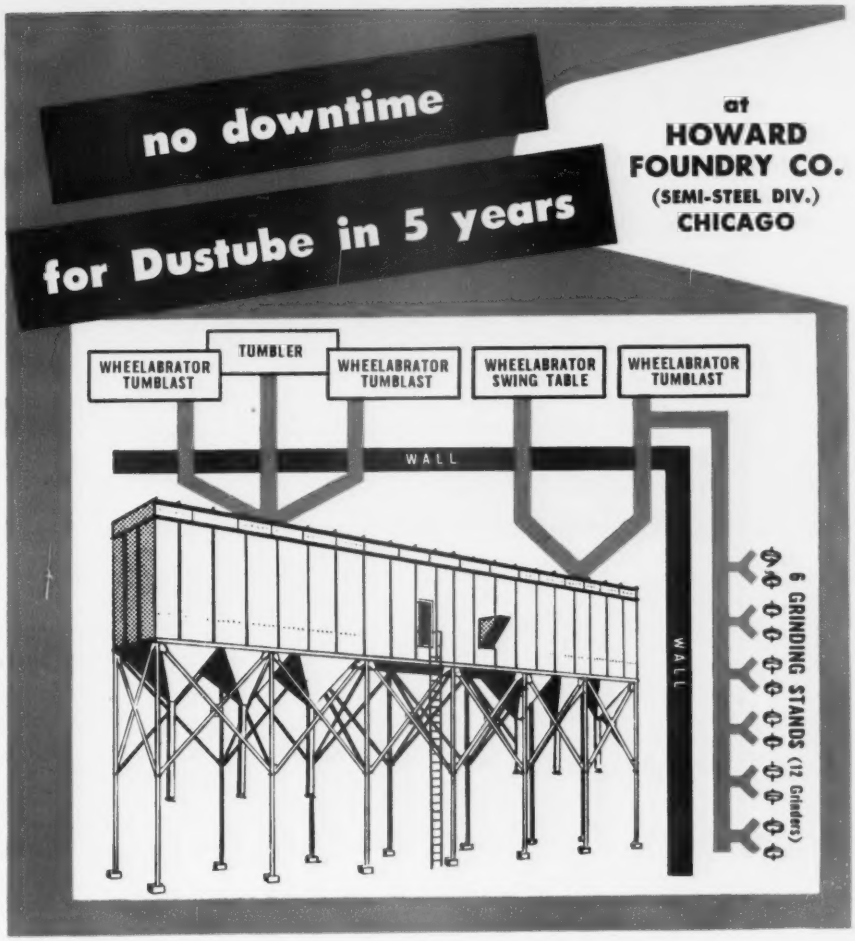
Book Review

Fundamentals of Casting Design as Influenced by Foundry Practice, by Oliver Smalley; fabricoid; ring binder 60 pages 9 x 11 in.; price $1.65; available through Meehanite Metal Corp., Pershing Square Building, New Rochelle, N. Y.

Devoted to iron castings, this book for the first time presents in a single unit the basic rules and fundamentals of correct casting design, to assure the casting user of the correct primary steps in securing sound, dependable castings. Many years study and research and experience of more than 100 Meehanite foundries all over the world provided material for the book.

Intimate and detailed information is presented in sections headed: General Design Rules; Patternmaking; Mold and Coremaking; Gating and Risering; Material Selection; Welding Hard Surfacing; Coating and Finishing Castings. Primary object of the study is to present to the designing engineer in as concise a form as possible the broad fundamentals of the founder's art so that he will have better appreciation of the problems involved in the manufacture of castings.

In the introduction the author points out what the engineer must know to design a casting so that actually it will have the requisite strength and functional properties. The foundryman must be able to make the casting so that it has the strength and functional properties intended by the engineer. The first is not an insolvable problem with today's instruments. The second involves engineer and foundryman. According to the author a comparatively small numbers of engineers are familiar with foundry practice. Foundrymen as a whole lack engineering training. The book shows engineers and foundrymen all the traps, snares and deadfalls, and how to avoid them.



A Dustube Collector at Howard Foundry Company, Semi-Steel Division, Chicago ventilates six grinding stands and five pieces of casting cleaning equipment. In the five years that this Dustube has been installed, not a single cloth tube or any of the working parts has been replaced. And the Dustube is efficient, too. Dust counts have shown that all harmful dust is exhausted from the cleaning room.

You can save yourself a lot of headaches and a lot of money too, by installing a Dustube. Its 9 profit-saving features add up to high efficiency and low cost operation. *Write for complete details.*

Mr. A. E. PORTER, Manager of the Semi-Steel Division, says:

"Foundry dust is not only expensive but also troublesome. We are extremely happy that this is completely eliminated in our finishing department with the Dustube Collectors and at an exceptionally low operating and maintenance cost. In terms of efficiency and cost saving performance, our Dustubes are the best investment we have ever made."

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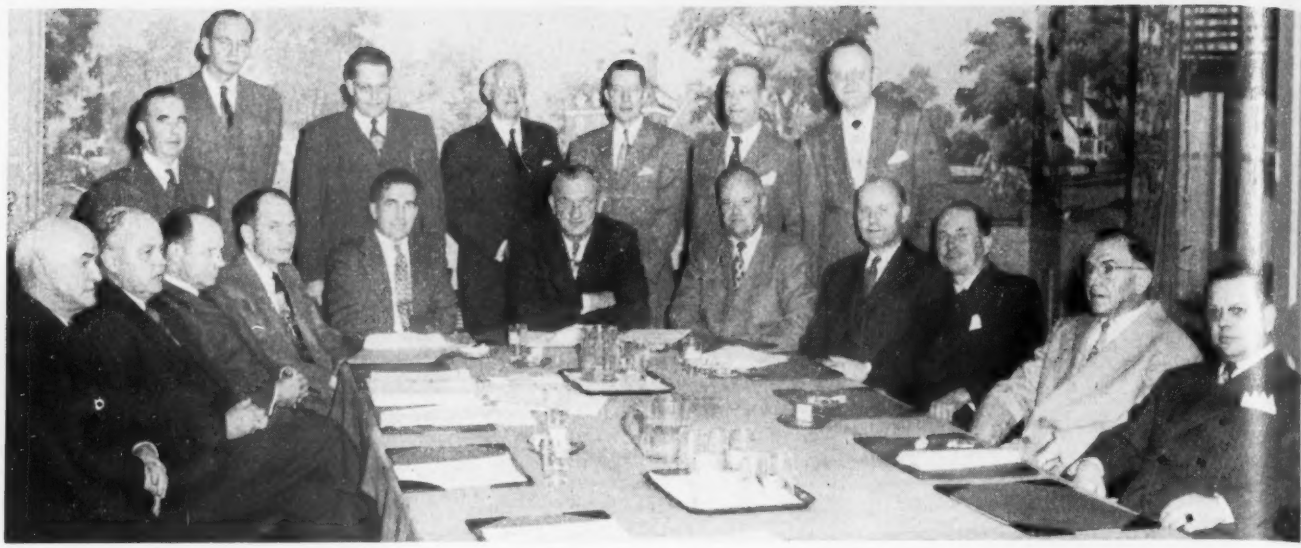

NFA administrative council for 1951. Left to right, seated: F. R. Hoadley, W. W. C. Ball, F. J. O'Neil, H. M. Greenbaum, Franklin Farrell III, H. E. Ladwig, A. V. Martens, A. G. Hall, J. J. Ewens, G. A. Kastner, E. N. Reynolds. Standing: I. R. Wagner, W. S. Brunk, A. L. McKay, L. E. Roark, C. A. Jurgensen, E. B. Sherwin, Herman Menck

National Foundry Association Holds 52nd Annual Meeting

by ERLE F. ROSS and HOWARD C. TUTTLE, *FOUNDRY*

DOWN-TO-EARTH advice on many problems requiring attention of top-level foundry management was offered in the program of National Foundry Association at its 52nd annual meeting at Edgewater Beach Hotel, Chicago, Nov. 9-10.

Speakers discussed the foundry industry's relation to mobilization, National Production Authority, materials supply, new tax laws and similar topics.

At the annual election of officers A. V. Martens, manager, Pekin Foundry & Mfg. Co., Pekin, Ill., was chosen president to succeed Harry E. Ladwig, Allis-Chalmers Mfg. Co., Milwaukee. Charles A. Jurgensen, works manager, DeLaval Steam Turbine Co., Trenton, N. J., was chosen vice president; E. B. Sherwin, president, Chicago Hardware Foundry Co., North Chicago, Ill., was re-elected treasurer, and Leroy E. Roark was re-elected executive vice president.

Importance of the foundry industry was emphasized in the report of NFA's outgoing president, Harry E. Ladwig, Allis-Chalmers Mfg. Co., West Allis, Wis. Citing that annual sales of the more than 5000 foundries in the industry total more than 16 million tons and about $3 billion, he noted that the average shop is comparatively small, 78 per cent of them employing less than 100 people. Their castings, he says, go into the end products of 90 out of every 100 manufacturers.

L. E. Roark, executive vice president, NFA, reviewed past accomplishments of the association and outlined its program for the future. Two specific tasks lie ahead: Encourage production; formulate cost systems for the industry. "In the field of production improvement," he said, "we expect to hold a series of seminars where production equipment experts can sit down with limited groups of foundrymen and point out to them where the use of certain types of equipment can bring economy and increased production."

The cost program, out of which will come a new cost manual, will involved talks on "all of the costs that enter into your production—not some of them." The association, he said, intends "to promote the discussion of taxation, depreciation, obsolescence, conservation of capital for replacement purposes, and numerous other features which some foundries have thought not a part of their program." Additionally, NFA is going to set up a Washington office, Mr. Roark disclosed, where at regular bimonthly meeting "we are going to talk to legislators about the foundry industry."

An insight into the personnel and basic philosophies of the National Production Authority was given by W. Howard Chase, consultant to the administrator, NPA. Concerning most of NPA's actions, he says, is the conviction that "we are not in Washington to prepare for the best that can

W. Howard Chase (left), National Production Authority, and new NFA President A. V. Martens, Pekin Foundry & Mfg. Co.

happen; we are preparing for the worst." People who make NPA tick, he declared, have "no interest whatsoever in controls for the sake of controls." They believe furthermore in using "a carrot instead of a stick" to encourage production. This philosophy, he says, steers away from restrictions on end-product manufacture, and operates, as much as possible by cutting back nonessential raw materials consumption. Effect of this type of control, he believes, will be stimulation of research and greater materials conservation than would be achieved otherwise.

NPA, he advised, is very much aware of its tremendous responsibility and its influence on the lives of millions of people. It is the will of the people that the country be adequately prepared for its defense, a job which will apparently cost between $35-$45 billion annually. Two main problems of the agency currently are that it has only incomplete knowledge of the military's requirements and it has a serious manpower problem. He told NFA's members that it is from groups such as this that NPA hopes to recruit able personnel.

Three requisites of a safety program which will be profitable were listed by J. C. Bradley, safety engineer, Pullman-Standard Car Mfg. Co. First, top management must be sold 100 per cent on the value of a safety program. Second, plant managers must be made to understand that the safety department is as important as production departments. Third, services of a good safety man are needed.

"Foremanship Development" was discussed by Arthur C. Croft, president, National Foremen's Institute. William Roberts, C.P.A., Murphy, Lanier & Quinn, Chicago, spoke on "Federal Taxation—Features in the New Law—Corporate and Personal." A surprise speaker at the convention was Fred A. Hartley, former congressman and co-author of the Taft-Hartley Act.

Of timely interest was a report on supply, demand and distribution of foundry raw materials by Angus J. Johnston, president, Hickman, Williams Co., and Hunter Hicks, Merchant Steel & Supply Co., Chicago, scrap broker. Mr. Johnston advised that production of foundry coke is approaching maximum, about 3 million tons a year. Foundries find it necessary to use smaller sizes of coke than they would normally prefer. Reduction in coking time would increase the quantity of coke produced but the deterioration in quality would also reduce the melt. "We will not cut corners," Mr. Johnston declared. He warned that higher coke costs should be expected as natural gas makes greater inroads on manufactured gas. The consumer will find his gas costs decreasing while his coke costs rise as the marketability of coke oven gas declines. Mr. Hicks expressed the belief that enough foundry scrap would be available in free market conditions. He said he doubted that there is much hoarding of scrap by traders at today's prices.

Two resolutions submitted by the association's resolution committee were adopted at the start of the closing session of the meeting. The first declared it "to be the policy of the National Foundry Association to urge its members to oppose the granting of union security and to seek the enactment of the right to work statutes in the various states, making illegal these undemocratic union security agreements," and the second set forth the policy "to urge its members to seek legislation restraining the monopolistic aims and practices of labor organizations."

Newly elected officers were installed, with President-Elect Martens assuming the chair and directing the balance of the session program.

Research has demonstrated that a great many unfavorable attitudes toward the employer and the free enterprise system result from, or are associated with, lack of knowledge of simple economic fundamentals, Edwin Vennard, vice president, Middle West Service Co., Chicago, asserted in an address on the "American Economic system." The speaker described and presented portions of a method which his company offers to assist employers to improve employee relations through explanation of fundamental economic facts. The method, consisting of three 2-hour employee meetings and conducted by a company's own employees who have been specially trained, utilized colored slide-film, demonstration and discussion group techniques.

The Nov. 7 election will not make as much difference as expected and hoped, observed Austin Kiplinger, business columnist, *Chicago Journal of Commerce,* and television commentator, in an address on "What's Ahead." It will not provide more steel, aluminum, and the like; will not reduce taxes; nor cause the United States to withdraw from world affairs. There will be continued spending for defense, more rearmament, more drafting for military service and more shortages.

On the other hand, he said, the election results probably will bring about reconsideration of tax policies, will cut down rigid rent control extension and will cause more cautious spending for foreign aid. Mr. Kiplinger told his listeners the country

At the NFA annual meeting. *Top row*—W. W. C. Ball, Franklin Farrel III, J. P. Wilkinson, H. C. Sterling. *Center row*—C. V. Nass, A. G. Hall, A. J. Johnston, H. C. Waldron. Bottom—George Fisher, Hunter Hicks

will have allocations and control of prices and wages but probably not before next fall.

Current misconceptions and unsettled issues were discussed by Sumner H. Slichter, professor of economics, Harvard University, Cambridge, Mass., in address on "Economics of a Defense Economy" presented at the luncheon meeting.

Five economic misconceptions he listed as follows: (1) Preventing inflation is considered the No. 1 problem. It is not—increasing production is No. 1. (2) Increase in taxes on corporate income does not increase prices. (3) Excess profits tax would be anti-inflationary. (4) It is wise to pay for defense and foreign aid programs solely by taxation. (5) Increase in the price level can be controlled by indirect methods. Prof. Slichter explained in detail why these are misconceptions.

Among unsettled questions he enumerated: (1) How big an increase in production can the country achieve in the next year? In his opinion, there might be only one-half of the normal 2½ per cent increase in manpower productivity next year. (2) Should the country tolerate the slowly rising price trend? (3) Will there be wage control? On this he commented that wage control is likely to be effective only with weak unions—not with strong. (4) If the government chooses not to control wages, can rising wages be held down by moral suasion, that is, labor-management bargaining?

In conclusion, Prof. Slichter asked what steps can be taken to keep inequities of inflation at a minimum. Those most affected—the white collar class—will be more articulate than in the past in expressing their dissatisfaction. Communities and business must not permit pensions to lag behind wages, and their must be protection of investments, savings, life insurance, and the like. He warned also that rent control must protect landlords against unfair treatment.

Apprenticeship Pamphlet

Designed especially for employers, Bureau of Apprenticeship, U. S. Department of Labor, Washington 25, has issued a pamphlet which outlines ten ways in which apprenticeship nets worthwhile returns. Also listed are other publications on the subject of apprenticeship which may be obtained from the bureau, as well as its regional offices and state apprenticeship agencies. Copies of the pamphlet "Apprenticeship Pays Dividends", are available upon request.

New Sand Testing Method

(*Continued from page* 154)

ly take longer than the particular time interval in which we are interested.

It was to overcome this basic difficulty that the testing technique and equipment described here were adopted. This method of testing is covered by U. S. Patent No. 2,491,512.

The technique is straightforward and simple. The sand sample, ¾-in. in diameter and 2 in. long, is placed in the furnace, which is maintained at the desired temperature. After heating for a predetermined period, the specimen is then raised instantaneously to a position immediately above the furnace where it is fractured by means of a transverse impact blow. The energy required to fracture the specimen is taken as a direct expression of toughness. The units of measurement are toughness units where one equals 100 gram-centimeters or the energy derived from the free fall of a weight of 100 grams through a distance of 1 centimeter.

Considerable development work went into the construction of the apparatus and the details of the testing procedure. The apparatus in its preferred form is shown in Fig. 1. This equipment is also fitted with an apparatus for measuring gas evolution from molding materials which, however, will not receive consideration here.

Referring to the boxed numerals on the photograph, the parts of the equipment applicable to the hot toughness test are:

1. Furnace capable of 3000° F, usually run at 2000° F.
2. Guides for specimen holder.
3. Specimen holder support.
4. Guide for locating specimen in testing position.
5. Striker in upper position.
6. Eccentric cam for magnifying spindle movement.
7. Dial gage for registering position of pendulum.
8. Magnetic release for striker pendulum.
12. Ammeter for furnace control.
13. Thermocouple indicator for temperature control.
14. Specimen preparation die (double compression method).
17. Transformer for voltage control.
18. Refractory specimen holder support.

The most informative technique has been found to consist of measurements of toughness after soaking at 2000° F for periods of 15 seconds up to 5 minutes. At 5 minutes the ¾-in. diameter sand sample is considered heated throughout its mass.

Results obtained with this method of testing have led to an entire change in the control of sand for the elimination of buckles, rat tails, veining and allied casting defects. Without delving into a mass of detailed test results, we may immediately point to the most significant conclusion reached with respect to buckling.

Two sands were tested as a direct comparison of behavior. The results are shown graphically in Fig. 2.

These results were obtained by testing the sands in the green condition, and each plotted point is the average of three determinations. The sands were taken directly from the same system making the same castings under the same conditions. Sand *A* gave excessive trouble due to buckles and Sand *B* was absolutely free from this difficulty. Sand *B*, incidentally, contained about 3 per cent corn flour.

Heat Sand Quickly

It will be noted that at a 6-minute soaking period, which is sufficient to insure complete heating throughout the sample, the toughness of the two sands are not materially different, the buckling Sand *A* being slightly tougher. If, however, we examine the form of the curves in the period up to 2 minutes of soaking, we notice a marked difference in behavior. Sand *A* exhibits a low but gradually increasing toughness whereas Sand *B* shows a remarkable increase in toughness within the first 45 seconds of heating action.

This tremendous increase in toughness during the initial period of heat shock determines the nonbuckling character of this sand. The toughness evidently is sufficiently high to resist spalling and rupturing forces developed from the phenomena of silica expansion and gas evolution.

Several case histories point to the elimination of buckling defects and rat tails by adjusting sand ingredients to give the type of hot toughness curve characterized by Sand *B* in Fig. 2.

Needless to say, the realm of impact testing of sand has been extended to include green toughness, dry toughness, retained toughness and so on. In general, it has been found extremely informative to record sand toughness in a single unit of measurement regardless of whether the sand is tested green, dry or at an elevated temperature.

A typical example of dry sand control by means of this method of test-

(*Concluded on page* 178)

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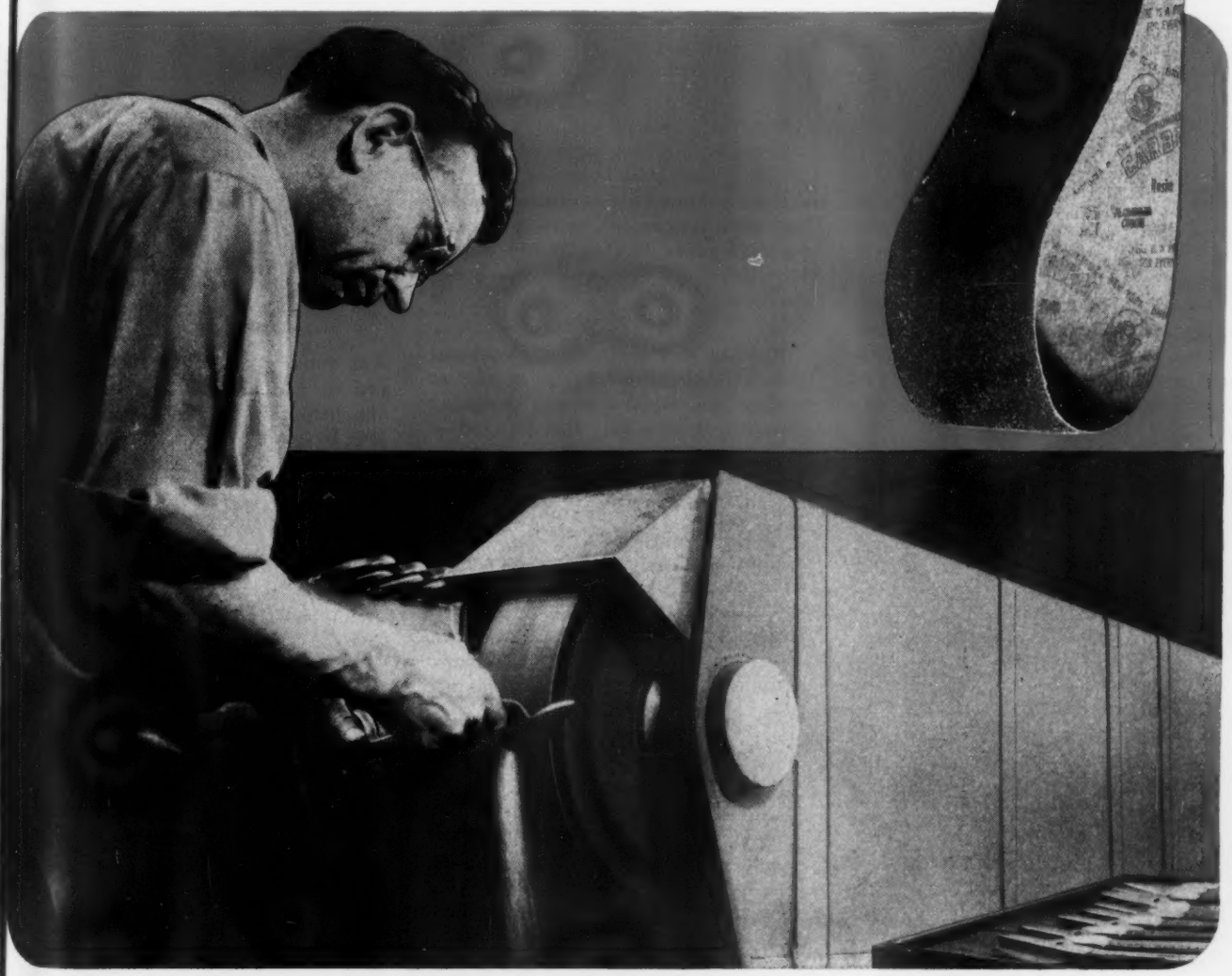

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(*Concluded from page* 176)

ing is given in Fig. 3.

In this case a dry sand facing which gave severe defects in the nature of scabs and washes gave the test results shown in Curve *A*. This same facing with added western bentonite gave complete freedom from trouble and gave the results shown in Curve *B*. Basically the form of the curve remained unchanged but the toughness was raised appreciably over the entire heating range used in the test.

Many more examples of test results could be quoted. Suffice it to say that the testing method has permitted an entirely new interpretation of sand behavior and has paid very definite dividends in reducing defective castings and in curtailing other costly items such as shakeout difficulties, and in providing economical core sand mixes.

OBITUARY

WILLIAM D. MOORE, 68, former president, American Cast Iron Pipe Co., Birmingham, died Nov. 11. A native of Hannibal, Mo., Mr. Moore was educated in the public schools of Galion, O. He went to Birmingham in 1907, and joined American Cast Iron Pipe Co. the following year as a mechanical engineer, becoming vice president and works manager in 1922. He was president of the company from 1924 to 1946, when he retired and became a partner in an agency in Birmingham, to assist consumers in the procurement of castings. Mr. Moore was the inventor of a centrifugal pipe casting process and an active member of many technical organizations. He served as a national director of American Foundrymen's Society in 1931-33.

WILLIAM D. MOORE

Frank T. McQuillin, 58, vice president in charge of production, Standard Buffalo Foundry Inc., Buffalo, died Nov. 19, following a long illness. Mr. McQuillin, a native of Norwalk, Conn., worked as a pattern maker there and in Syracuse, N. Y., before going to Buffalo in 1912. He joined Standard Foundry, which was consolidated with North Buffalo Hardware Foundry in 1936 to form the present company. He became manager of plant operations at that time and became vice president in 1949.

* * *

L. R. Meyer, 59, assistant works manager of the Verona, Pa., plant, American Steel Foundries, Chicago, died Oct. 29. Mr. Meyer joined the Pittsburgh plant in 1913 as a patternmaker. He went to Verona when the plant was transferred there and became foundry superintendent and later assistant works manager.

* * *

William B. Magnuson, 53, engineer, Champion Foundry & Machine Co., Chicago, died Dec. 1 in that city, following several years of ill health. He had been associated with the company 32 years. During World War I, Mr. Magnuson served in the Army overseas.

* * *

Richard B. Proudfoot, 37, assistant general superintendent in charge of casting and electroplating, Cleveland Graphite Bronze Co., died Dec. 10. A graduate of Case Institute of Technology, he was also executive secretary of Falls Industries, Solon, O.

* * *

John Andrzejczak, 71, owner of Layton Park Pattern Works, Milwaukee, died there Nov. 17. Mr. Andrzejczak, known as John Andrews, was born in Poland. He has owned and operated the pattern works since 1922.

* * *

Robert W. Trump, 78, former president and owner of the old Philadelphia Stove & Iron Foundry Co., Philadelphia, died Nov. 4. Mr. Trump had been active in business for 50 years prior to his retirement in 1941.

* * *

Charles T. Moffett, 82, former superintendent of the foundry division, Whitin Machine Works, Whitinsville, Mass., died Nov. 15. He was associated with the foundry 43 years, until his retirement 14 years ago.

* * *

William L. Bond, 58, founder and managing director, Bond Brass Ltd., Eastview, Ont., died Nov. 19. A native of Toronto, for 33 years Mr. Bond was manager and superintendent, Ottawa Car & Foundry Co., Ottawa, Ont., until he founded his own business three years ago. He was a charter member and past director of the Eastern Canada Chapter of the American Foundrymen's Society.

* * *

William W. Carver, 59, vice president and assistant general manager in charge of sales and purchases, Auto Specialties Mfg. Co., St. Joseph, Mich., died there recently. A native of Chicago, Mr. Carver joined the company as a stenographer when it was founded there in 1909. Advancing in various positions he followed the corporation from Chicago to Joliet, Ill., and then to St. Joseph in 1917. He was the oldest member of the company's staff in years of service.

WILLIAM W. CARVER

* * *

Harry Land, 83, owner and operator of the Harry Land Foundry, Richmond, Ind., died Nov. 8. A native of Richmond, he was secretary of the Wayne Works Co. prior to forming his foundry company.

* * *

Rudolph P. Seitzinger, 69, co-owner and operator of Thomas F. Seitzinger's Sons, Atlanta foundry, died Nov. 19. He had been associated with the company 44 years.

* * *

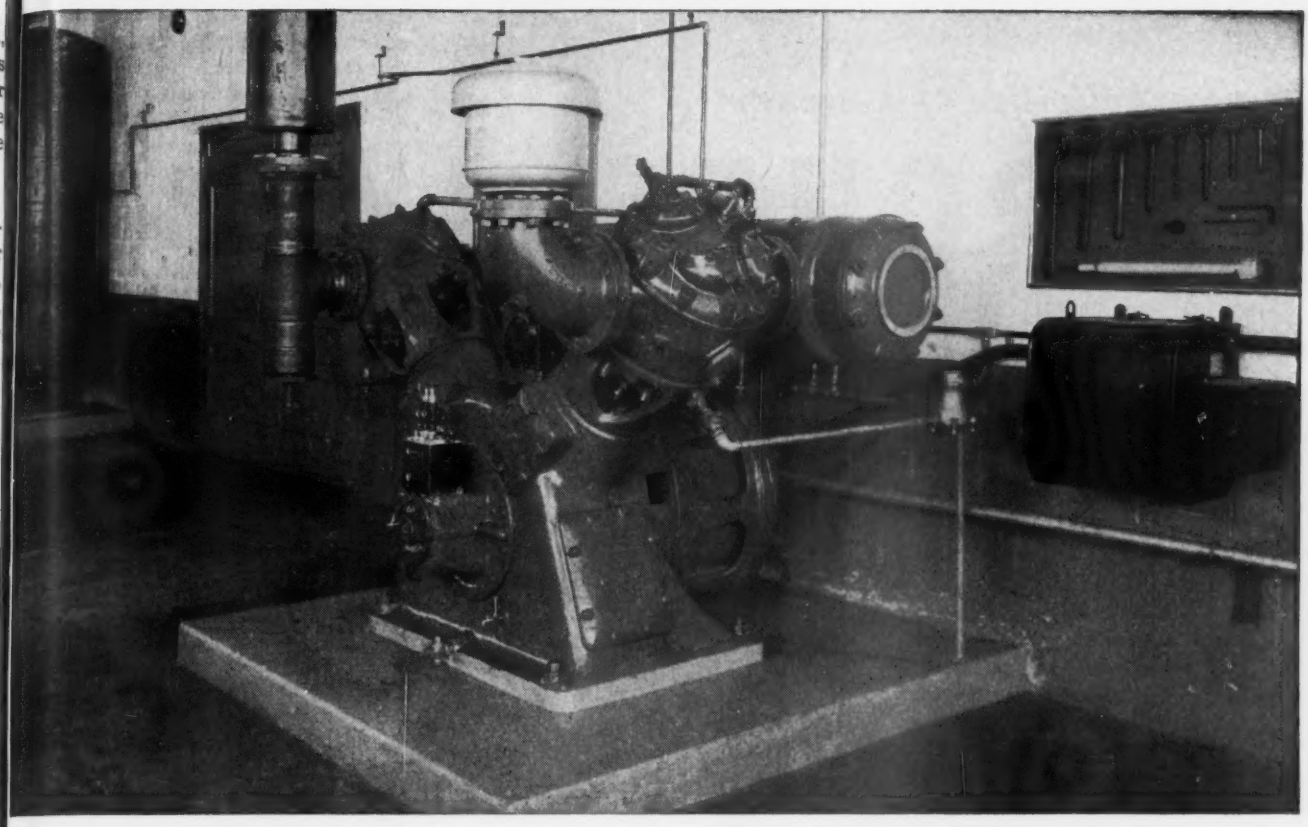
Bert E. Sandell, 46, chief metallurgist and assistant plant superintendent, Stewart Die Casting Division, Stewart-Warner Corp., Chicago, died there Nov. 14.

* * *

George R. Ouellette, 59, president, Grant Bros. Foundry Co., Detroit, died Nov. 2, following 40 years with the company.

* * *

Noah H. Jacobsen, 68, president, Western Materials Co., Chicago, supplier of foundry sands, died Nov. 20.



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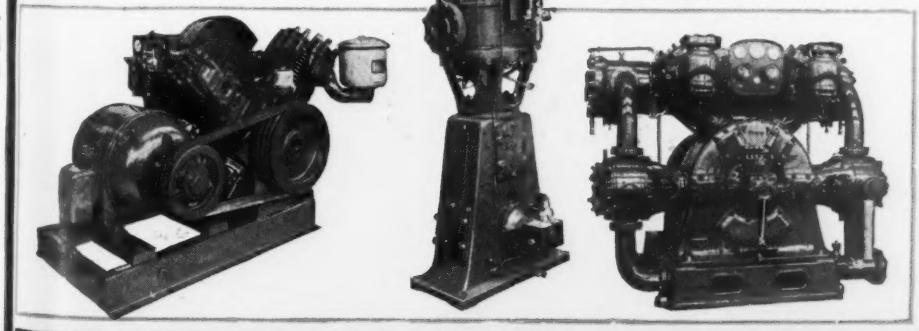

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GROUPS

Pittsburgh

PRINCIPLES of Risering" was discussed by Charles F. Walton, Case Institute of Technology, Cleveland, at the Oct. 16 meeting of the Pittsburgh Foundrymen's Association held at the Fort Pitt Hotel, Pittsburgh.

In enumerating fundamental factors involved in risering, Mr. Walton stated that the principal—but not all—requirements for a riser to produce a sound casting successfully can be summed up as follows: A directional solidification pattern must be established in the casting; the riser must be attached to the last part of the casting to solidify; the riser must solidify after the casting; and the riser must be capable of supplying sufficient liquid metal to the casting.

Solidification contraction in a casting depends upon the metallurgical classification of the metal being poured, the size and shape of the casting and the risering and gating practice.

In discussing "The Effect of Mold Materials on Metal Shrinkage," at the Pittsburgh association's Nov. 20 meeting, Walter F. Bohm, assistant foundry metallurgist, Buick Motor Division, General Motors Corp., stated that until comparatively recently it has been the general consensus that metal composition determines whether or not a casting will develop a so-called shrink cavity. Recent investigations, however, have shown that mold materials also exert a very potent influence.

At the Buick foundry much information has been gathered concerning mechanism by which these cavities are formed and the relationship of mold materials. Briefly, the mechanism seems to be mold wall movement during critical period after all feeding has ceased due to gates being frozen. This is seen from the close correlation of cavities with diameters; namely, the larger the diameter, the larger the resulting cavity. From the mold material viewpoint, it was found that southern bentonite, seacoal, wood flour, cereal and baked oil sand would diminish the tendency toward an outward mold wall movement and consequently the tendency to shrink as well.—*J. C. Sullivan*

Quad City

SPEAKER for the Nov. 20 meeting of Quad City Chapter of the AFS was Robert P. Schauss, Illinois Clay Products Co., Chicago. His topic was "Gating and Feeding of Castings."

The speaker cited the importance of proper gating and feeding and the necessity for establishing such systems on scientific principles rather than the trial and error method.

Mr. Schauss explained the generally accepted ideas on gating and feeding, comparing the old conceptions with the newer ideas brought out by research work at Battelle Memorial Institute and Massachusetts Institute of Technology. The flow of the metal into the mold should be controlled since either too fast or too slow rate will produce defects. Gates should be adequate so that hot metal will be supplied where needed.

In the discussion it was brought out that recent work has proved that 1:4:4 for sprue-runner-gate ratio is superior to the 1:2:4 ratio previously accepted as ideal. It was also brought out that an increasing number of foundries are using ceramic materials for strainer cores and neck-down risers. — *E. C. Zirzow, Deere & Co.*

Birmingham

TECHNICAL meetings arranged by Birmingham District Chapter of the AFS in October and November proved to be most interesting and attracted more than 125 members and friends at each meeting. In October Tom Barlow, sales manager, Eastern Clay Products Inc., Jackson, O., gave an interesting discussion on "Bondactor Process for Cupola Lining." In November Frank W. Less, Durez Plastics & Chemicals Inc., North Tonawanda, N. Y. was the speaker on "The 'C' Process for Molds and Cores." Mr. Less is an authority on phenolic resins and their applications in many industries.

The social hour preceding dinner each month has been under the direction of E. A. Brandler, chairman of the Entertainment Committee. Other members of the committee are William Bach, Gene Welchel and Lipscomb Carl. Morris Hawkins, Stockham Valves & Fittings, and chairman of the chapter, presided at the meetings and Charles K. Donoho, Amer-

(*Continued on page* 182)

NORTHWEST REGIONAL Foundry Conference, sponsored by Washington, Oregon, and British Columbia Chapters of the AFS and the College of Engineering, University of Washington, was held at Seattle, Oct. 13-14. Luncheon group in the student union building is shown above

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(*Continued from page* 180)
ican Cast Iron Pipe Co., introduced the speakers and served as discussion leader during the question and answer period which followed.

Next meeting of the chapter will be Jan. 19, with Richard A. Flinn, American Brake Shoe Co., Mahwah, N. J., as the speaker. Plans are being completed for the chapter's 19th annual foundry practice conference to be held in Birmingham at the Tutwiler Hotel, Feb. 22-23—*J. P. McClendon, Stockham Valves & Fittings*

Twin City

JOINT meeting of Northwest Chapter of the ASM and Twin City Chapter of the AFS was held Oct. 19. Fred G. Sefing, Internationl Nickel Co. Inc., New York, discussed factors affecting metal to metal wear—especially in cast iron.

Mr. Sefing classified wear into four types: Physical deformation due to repeated over straining in pressure or shear; corrosive wear is due to chemical degradation; abrasive wear; and physical removal of particles by scoring, galling or seizing.

Mr. Sefing showed microstructure slides showing how a weak ferritic matrix promotes wear, and coarse irregular structure courts dislodgment. He showed how unrelieved internal stresses increase wear by weakening matrix resistance and how the wear resistance of heavily machined surfaces is often improved by light machining to remove distorted and partially fractured surface metal. He illustrated the high wear resistance of cast irons containing finely divided anti-weld graphite structure. Mr. Sefing showed how the same principles of wear resistance apply to tool wear in high-speed steel, to the superfinish honing of cylinder walls, and to the use of chrome plate, phosphate coating, nitriding, etc.

More than 80 members of Twin City Chapter welcomed Harry W. Dietert, Harry W. Dietert Co., Detroit, as principal speaker at the Nov. 14 meeting.

According to Mr. Dietert, molding sand testing may be divided into six categories: Structural, green properties, air set, dry, hot and retained strength. The trend in gray iron foundry practice is toward higher green strength. Twenty pounds psi green bond is not uncommon. The yield point of a good molding sand should be near the point of maximum deformation and the deformation range should be 0.016 and 0.020 inches per inch. Casting defects such as shrinkage can be caused by too high deformation sands.

Mr. Dietert suggested the following limits for a good workable gray iron sand which can be made to produce quality castings at a rapid rate: Dry compression, 120 psi maximum; mold hardness, 70-80; air set strength, 20-100 psi; hot deformation, 1000° F, 0.008-in. to 0.012 in. per inch; hot strength, 1000° F, 20-80 psi. He stated that hot expansion and retained strength should both be kept as low as possible.—*O. J. Myers, Archer-Daniels-Midland Co. and Knox A. Powell, Minneapolis-Moline Co.*

Detroit

NOVEMBER meeting of Detroit Chapter of the AFS was "Past Chairman's Night" and was held at the Detroit-Leland Hotel. Fred Walls, International Nickel Co., Detroit, a

(*Continued on page* 184)

DETROIT Chapter of the AFS held past chairman's night at Detroit-Leland Hotel in November. At upper left, Dick Lang is shown selling raffle tickets to William Winter. At upper right, left to right, are past chairmen Ray Wilcox, Omer Allen, Vaughan Reid, Fred Walls and W. P. Putnam. Lower left, Jess Toth, (right) pins new identification badge on Elmer Gerhard. At lower right, Dr. Robert F. Thompson (right) shows film to Vaughan C. Reid. Photos by courtesy of R. Grant Whitehead, Claude B. Schneible Co.

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(*Continued from page* 182)

past chairman of the chapter and also a past president of the AFS, reminisced on the activities of the Detroit group since 1896 and introduced the past chairmen present at the meeting.

Dr. Robert F. Thompson, General Motors Research Division, and chairman of the research committee of the AFS Aluminum and Magnesium Division, showed the colored sound film entitled "Fluid Metal Flow." Mr. Thompson was presented a set of chapter book ends by Vice Chairman Vaughn C. Reid, City Pattern Foundry & Machine Co.

Next meeting will be Jan. 18 at the Detroit-Leland Hotel and the topic for discussion will be "Quality Control by Statistical Methods."—*R. Grant Whitehead, Claude B. Schneible Co.*

NON-FERROUS FOUNDERS' SOCIETY directors attended a clambake at the summer home of Past President Walter M. Clark, D. W. Clark & Co., Boston, at Buzzard's Bay near Boston, Oct. 15. Shown above, left to right, are: J. D. Zaiser, Ampco Metal Co. Inc., Milwaukee, society president elect; Raymond E. Bietry, B & S Bronze Foundry Inc., Brooklyn, N. Y.; Miss D. Ostroff, Thos. Paulson & Son Inc., Brooklyn; Roy Jacobs, Standard Brass Works, Milwaukee, society past president, and William Leary, Metropolitan Brass Founders' Association, New York

Central New York

EIGHTY-FIVE members and guests were present at the Nov. 10 meeting of Central New York Chapter of the AFS held at the Mark Twain Hotel, Elmira, N. Y. Chapter Chairman David Dudgeon Jr., Utica Radiator Corp., Utica, N. Y., introduced Guy A. Pealer, co-ordinator of methods development and casting design for the Elmira foundry works of General Electric Co. Mr. Pealer's subject was "Pattern Engineering and Co-Ordination of Methods To Produce Better Castings."

The speaker's talk was based upon 34 years' experience in the field, all of which were gained with the General Electric organization. He began as a patternmaker in 1916 and progressed through various assignments to his present position. Mr. Pealer pointed out that in designing pattern equipment for any particular foundry, the molding methods of that foundry should be considered. He also recommended that when foundries quote prices to their customers, they quote both pattern and casting prices based on the various types of patterns, namely: A loose solid wood pattern, a split pattern or a matchplate. This he believed would be of great value to the customer.

Mr. Pealer also compared castings with weldments, showing in some cases castings were more economical to make and also presented a better appearance. He stressed good housekeeping in foundries in order to attract a better grade of help and constant improvement in quality and appearance of castings to combat competition from plastics and weldments—*James W. Ogden, Cleveland Tramrail Syracuse Co.*

Central Pennsylvania

SECOND meeting of the season for the Central Pennsylvania Foundrymen's Group was held Nov. 1 in the art gallery of the School of Mineral Industries, Pennsylvania State College.

Thomas E. Eagan, Cooper-Bessem-

(*Continued on page* 186)

MANAGEMENT DINNER was held by Philadelphia Chapter of the AFS Nov. 21 at the Union League Club, Philadelphia. Bottom, left to right, are: Gen. Donald Armstrong, U. S. Pipe & Foundry Co., principal speaker; C. B. Jenni, General Steel Castings Corp., chapter chairman; Walton L. Woody, National Malleable & Steel Castings Co., national AFS president, and H. Johnson, General Steel Castings Corp.

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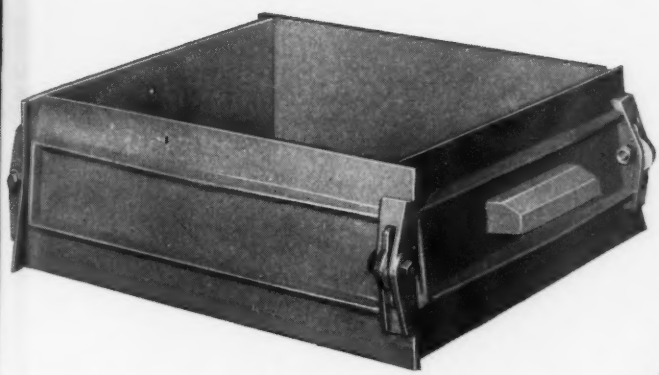

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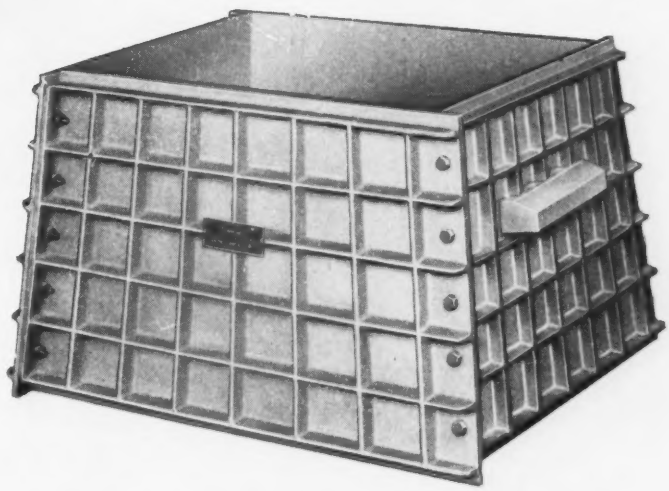

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(*Continued from page* 184)

er Corp., Grove City, Pa., addressed the group on "The Practical Aspects of Nodular Iron." Mr. Eagan presented two sides of the subject. He first discussed matters of interest to the foundryman and metallurgist, including such items as desired compositions, structural control, treatment materials and foundry characteristics. The second part of the talk dealt with certain facts which interest engineers and designers in connection with the group of materials. Mr. Eagan emphasized that the structural durability of the component part is the matter of prime concern. Slides were shown of various parts and pieces of equipment, and Mr. Eagan discussed the pro's and con's for nodular iron in these applications. — *W. J. Reagan, Pennsylvania State College.*

WISCONSIN Chapter of the AFS met at Hotel Schroeder, Milwaukee, Nov. 10. Fig. 1, left to right, are: C. M. Lewis, Badger Malleable & Mfg. Co.; N. Amrhein, Federal Malleable Co.; Frank Wabiszewski, Maynard Electric Steel Castings Co.; E. L. Roth, Motor Castings Co., and W. R. Tanner, Zenith Foundry Co. Figs. 2 and 3, table groups. Fig. 4, left to right: R. C. Woodward, Bucyrus-Erie Co.; William J. Grede, Grede Foundries Inc., principal speaker; Chapter President W. W. Edens, Badger Brass & Aluminum Foundry Co.; G. E. Tisdale, Zenith Foundry Co., and C. S. Anderson, Belle City Malleable Iron Co. Fig. 5, left to right: R. W. Osborne, Lakeside Malleable Castings Co.; J. E. Schaible, Crucible Steel Casting Corp., and C. W. Schwenn, Brillion Iron Works Inc. Photos by Walter V. Napp, Badger Firebrick & Supply Co.

Wisconsin

NOVEMBER meeting of Wisconsin Chapter of the AFS, held at Hotel Schroeder, Milwaukee, was termed "Management Night." William J. Grede, president, Grede Foundries Inc., Milwaukee, was the speaker on the subject "Selling the American Tradition."

Mr. Grede stated in part: "When we talk about freedom in this country, we must understand what freedom really is; and why shouldn't we talk more about freedom among ourselves? We need more of the old Fourth of July talk about it. We have a foundry at Iron Mountain, Mich., where a group of school teachers paid us a visit a while ago. They asked questions such as 'What does your company do on the human side of business?' We showed that we do a lot for our employees, such as accident prevention, and that we had no serious accidents for a period of 452 working days. We put in a pension program, and group insurance. All this helps keep men on the job and we find it is good business to do these things for our employees. I am unalterably opposed to the closed shop philosophy against freedom of the individual. There is no such thing as a little socialism; it must be complete to work at all and that is difficult to attain."

In addition, motion pictures were shown of the best football games in various sections of the country during this year and last. Since the current football season was in full swing, these proved highly interesting and many good plays shown were applauded as though the audience were at the games.—*John E. Hubel*

Eastern Canada

NOVEMBER meeting of Eastern Canada Chapter of the AFS was held at Sherbrooke, Que. A problem casting forum was conducted in which a panel of foundry experts was presented a casting blueprint and discussed the most efficient and economical way of producing both the pattern and casting.

Lucien Guilmette, Canadian Foundry Supplies & Equipment Ltd., and chairman of the chapter, conducted the general meeting while W. T.

(*Continued on page* 188)

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BOARD MEETING: Shown attending a regular board of directors meeting of Northern California Chapter of the AFS Oct. 27 are, left to right: Davis Taylor, American Wheelabrator & Equipment Corp., San Francisco, chapter secretary; John Russo, Russo Foundry Equipment Co., Oakland, Calif., chapter president; W. W. Maloney, national AFS secretary, and Fred Mainzer, Pacific Brass Foundry of San Francisco Inc., chapter treasurer. Photo by Sam Russell, Phoenix Iron Works

(*Continued from page* 186)

Shute, Canadian Car & Foundry Co. Ltd., Steel Casting Division, conducted the forum. Those acting as foundry experts were: Leonard Bradley, Canadian Ingersoll-Rand Co. Ltd.; Wilfrid Legere, La Fonderie Legere; James H. Clark, Canada Iron Foundries Ltd.; Henry Louette, Warden-King Ltd.; James Grieve, Dominion Engineering Works Ltd. and William Birks, Crane Ltd.

To assist in the discussion of the problem casting—which the blueprint specified as being a cast iron still for the Enigma Distillery Corp., Alcatraz, Calif.—Ed Laurendeau, Canadian Pattern & Woodworking Co., had prepared a sample core box and pattern; and Henry Louette, Warden-King Ltd., had made castings from those patterns. All of this equipment was exhibited at the meeting.

The Sherbrooke meeting was the first regular monthly meeting of the chapter to be held outside of Montreal, and approximately 70 members attended from out-of-town points.—*M. G. McQuiggan, Canadian Foundry Supplies & Equipment Ltd.*

PHILADELPHIA Chapter of the AFS met at the Engineers Club, Philadelphia, Nov. 10. Shown at top left is Dr. Stanley P. Reiman, director, Lankenau Hospital Institute and Institute for Cancer Research, who spoke on cancer. Top right, left to right, are: H. J. Williams, sales manager, New Jersey Silica Sand Co., Millville, N. J., and Earl E. Woodliff, sand consultant, Detroit, principal speaker. General view of the meeting is shown at bottom

Central Illinois

NOVEMBER meeting of Central Illinois Chapter of the AFS had as its speaker Russell J. Anderson, works manager of Belle City Malleable Iron Co., Racine, Wis., whose talk was entitled, "Keeping the Foundry Up to Date."

The speaker stated that although the foundry is one of the oldest industries, it has been slow to advance. However, if it continues to improve as it has in recent years, it will soon become one of the most advanced industries. He pointed out that the art of making castings dates back as far as 4000 BC and at present more than a million tons of castings are made each month. In addition to his talk, Mr. Anderson showed a number of slides on the production improvements incorporated at the Belle City Foundry.—*Robert J. Paluska.*

Philadelphia

ANNUAL Management Dinner of Philadelphia Chapter of the AFS was held at the Union League Club, Nov. 21. Approximately 130 were present. Invited guests in attendance were Walton L. Woody, national AFS president, William W. Maloney, AFS secretary-treasurer, E. C. Troy, national director, Rear Adm. Rico Botta, Naval Air Material Center, Philadelphia Naval Base; Capt. L. A. Kniskern, commander, Philadelphia Naval Base; Col. William V. Ghormly, Frankford Arsenal, Philadelphia; Lt. Nertherling, chaplain, Philadelphia Naval Base, who gave the invocation. Toastmaster was Harvey Johnston, General Steel Castings Co., Eddystone, Pa.

Mr. Woody preceded the speaker of the evening, giving an informal talk on AFS national and chapter activities and the part the foundry industry plays in national affairs. Featured speaker was Gen. Donald Armstrong, president of the United States Pipe & Foundry Co., Burlington, N. J., who served in the U. S. army for 37 years. During World War II he was chief of the Chicago

(*Continued on page* 190)

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(*Continued from page* 188)
Ordnance District and later was commandant, Industrial College of the Armed Forces. With this background, he was well qualified to discuss "Company Planning for Industrial Mobilization." General Armstrong left no doubt in the minds of his listeners that for industry as a whole to give its best to the armed forces, or the nation in time of national emergencies, management at all times should know the full strength of its plants, in production, quality of product, machinery and manpower requirements. Above all, it must know the morale of the entire organization.

Regular monthly meeting of Philadelphia Chapter was held Nov. 10 with approximately 150 members present. Dr. Stanley P. Reiman, director of Lankenau Hospital Institute and Institute for Cancer Research, discussed the research work that is being done at the institute. Lankenau Hospital has one of the best equipped laboratories for cancer research in the world.

CHICAGO Chapter of the AFS held roundtable discussions Nov. 6 at the Chicago Bar Association. Fig. 1 shows the malleable iron section under Chairman B. C. Yearley, National Malleable & Steel Castings Co. Left to right, are: Ted Czima, National Malleable & Steel Castings Co.; H. W. Maack, Crane Co.; Frank Czapski, Chicago Malleable Castings Co.; C. F. Semrau, Illinois Malleable Iron Co.; E. A. Radke, Malleable Division, International Harvester Co., and William Moran, William E. Pratt Mfg. Co. Speakers' table is shown in Fig. 2. Left to right, are: Deming Lucas, foundry consultant, membership committee chairman; Bert Eleder, Link-Belt Co., steel division chairman; Charles Christopher, Continental Foundry & Machine Co.; Chester V. Nass, Pettibone Mulliken Corp., chapter chairman; Robert Hendry, Love Brothers Inc.; Fred Riddell, H. Kramer & Co., nonferrous division chairman; William Rudin, Elesco Smelting Co., and Mr. Czapski. In Fig. 3 Mr. Rudin is shown addressing the nonferrous session. Fig. 4 shows Mr. Hendry addressing the gray iron and pattern session. Photos by I. H. Dennen, Beardsley & Piper Division, Pettibone Mulliken Corp.

Principal speaker was Earl E. Woodliff, sand consultant, Detroit, whose subject was "Sand Control." H. J. Williams, New Jersey Silica Sand Co., Millville, N. J., served as technical chairman.—*G. H. Bradshaw, Philadelphia Naval Shipyard.*

Chicago

NEARLY 200 members of Chicago Chapter of the AFS and guests turned out Nov. 6 at the Chicago Bar Association for the first roundtable meeting of the 1950-51 season. Chapter President Chester V. Nass, vice president, Pettibone Mulliken Corp., presided. It was announced that more than 250 already had enrolled for the chapter-sponsored Foundry Sand Control School conducted Nov. 27-30 at Navy Pier Division, University of Illinois, by the Harry W. Dietert Co., Detroit. Plans are nearing completion for the foundry demonstration course to be held the second and fourth Monday evenings during January, February and March.

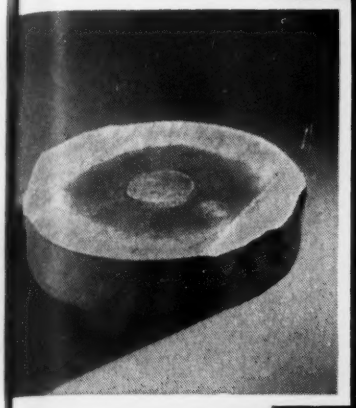
Group session sponsored by the Steel Division was devoted to "Development of Steel Compositions and Physical Properties." Charles F. Christopher, research metallurgist, Continental Foundry & Machine Co., East Chicago, Ind., was the speaker and Bert Eleder, assistant superintendent, Link-Belt Co., was chairman.

Malleable Division conducted a "Clinic for Foundry Headaches" specializing in metal, melting and annealing, with Frank A. Czapski, metallurgist, Chicago Malleable Castings Co., in the role of "chief surgeon." Members of the "consulting staff" were: E. A. Radke, metallurgist, Malleable Division, International Harvester Co.; C. F. Samrau, associated with Illinois Malleable Iron Co.; H. W. Maack, chief chemist and metallurgist, Crane Co.; Frederick G. De Mien, metallurgist, Moline Malleable Iron Co., St. Charles, Ill.; William Moran, foundry superintendent, William E. Pratt Mfg. Co., Joliet, Ill., and T. A. Cizma, superintendent of melting, National Malleable & Steel Castings Co., Cicero, Ill.

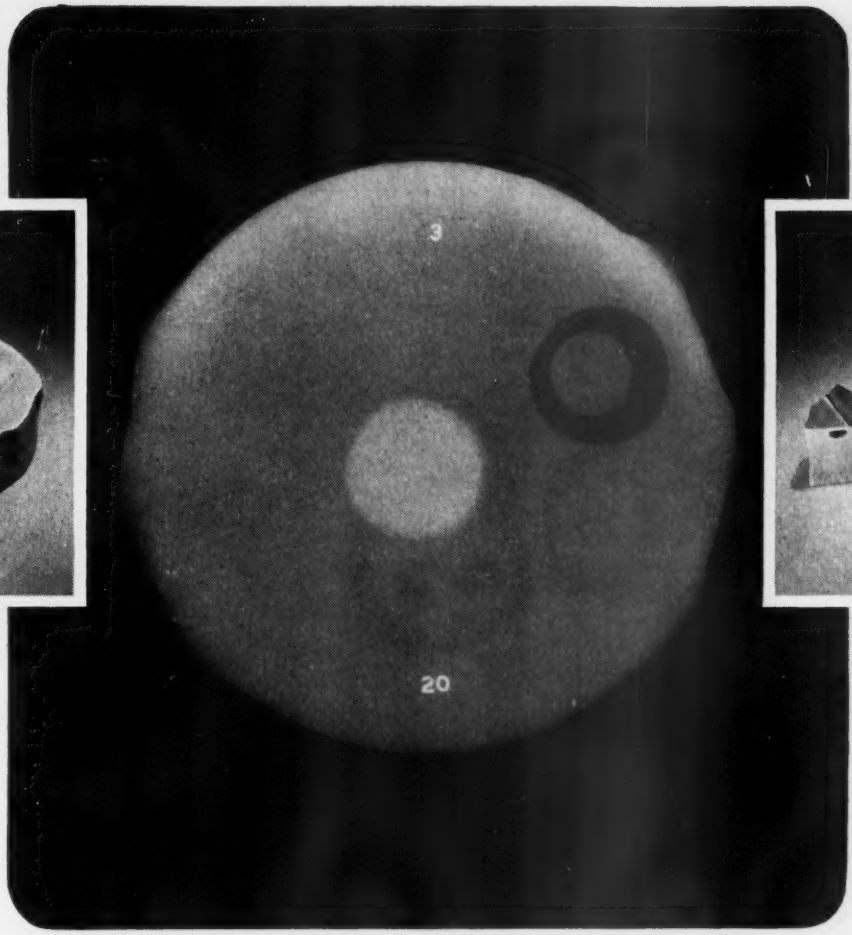
A foundry practice question-and-answer clinic was engaged in by the Nonferrous Division with William L. Rudin, chief metallurgist, Elesco Smelting Corp., discussion leader. Fred L. Riddell, foundry metallurgist, H. Kramer & Co., presided.

The Gray Iron and Pattern Divisions joined forces in a roundtable on "Co-Operation between Jobbing Foundry and Pattern Shop." Robert Hendry, foundry superintendent, Love Bros. Inc., Aurora, Ill., was the speaker and H. K. Swanson, owner, Swanson Pattern & Model Works, East

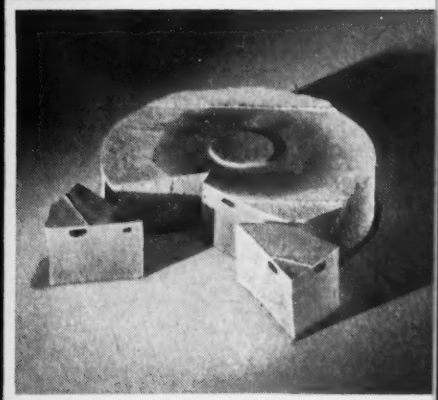
(*Continued on page* 193)



Aluminum alloy casting 2¼ x 1¼" for aircraft accessory part.



Radiograph which revealed defect in casting.



Section reveals hole detected by radiography.

Minutes of Radiography saved hours of machining

AFTER machining, this aluminum alloy casting was to be an important part in an aircraft accessory, vital to high-altitude flying. The finished part was needed quickly by the customer. Design specifications demanded high quality.

This was no time to wait for machining to disclose any defects. There was too much to lose —setup time, machining time, take-down time, as well as the reputation of the foundry.

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(*Continued from page* 190)

Chicago, Ind., was chairman. Among the comments made by Mr. Hendry were that there is co-operation at present but more is needed; not enough time is put on engineering of patterns; proper patterns produce less foundry scrap; and the patternmaker is in a sense a toolmaker for the foundry.—*Erle F. Ross.*

Central Michigan

SIXTY-SIX members and guests of Central Michigan Chapter of the AFS met at the Hart Hotel, Battle Creek, Mich., Oct. 18. Lachlin Currie served as technical director and introduced the speaker, Paul Moore, counselor, management and development department of continuing education, Michigan State College, who spoke on "Participation Increases Production."

Mr. Moore believes current production is approximately 30 per cent of the potential output. Even under wage incentive plans, industrial workers tend to produce below their potential. Only by improvements in the field of human relations can this obstacle be overcome. Mr. Moore believes the history of industrial human relations can be divided into three eras. The first, 25 to 50 years ago, was one in which force predominated, with little emphasis on human relations. The second, in which most industrial concerns find themselves today, is one in which honest effort is being made for good employer-employee relationships.

Era number three, which we are now approaching, will be characterized more and more by participation plans. Mr. Moore is a particular advocate of the Scanlon plan, a production-sharing plan. Regardless of profits, certain percentage of the cost of production is allocated to the workers, which is then divided among them according to rates. — *J. T. Ehman.*

New Jersey

STATE legislative matters affecting the foundry industry were discussed at the regular monthly meeting of the New Jersey Foundrymen's Association at the Military Park Hotel, Newark, N. J., Oct. 16. Speakers included Percy A. Miller Jr., Commission of Labor and Industry, state of New Jersey, Albert H. Acken, secretary, and Henry Chase, assistant director, Social Security and Insurance Department of the State Chamber of Commerce.

H. L. Edinger, Barnett Foundry & Machine Co., Irvington, N. J., was elected president; Audrey E. Winstead, Moore Bros., Elizabeth, N. J., vice president; John L. Carter, Newark, secretary; and J. A. Williamson, Newark, treasurer.—*Ben K. Price.*

Washington

DISCUSSION of "Sand and Its Relationship to Casting Defects" was presented by Tom Barlow, sales manager, Eastern Clay Products Inc., Jackson, O., at the Nov. 24 meeting of Washington Chapter of the AFS, in Seattle.

Mr. Barlow pointed out that sands which are too dry result in cuts and washes caused by low green, dry or hot strength due to insufficient moisture to temper the clay. Remedy is to increase moisture. On the other hand, sands too wet cause roughness due to poor flowability as well as defects caused by low permeability. While increased moisture may lower green permeability only slightly, hot permeability may drop to zero because the sand voids become so loaded with steam that it is impossible for the sand to vent other gases formed. Remedy in this case is to reduce mois-

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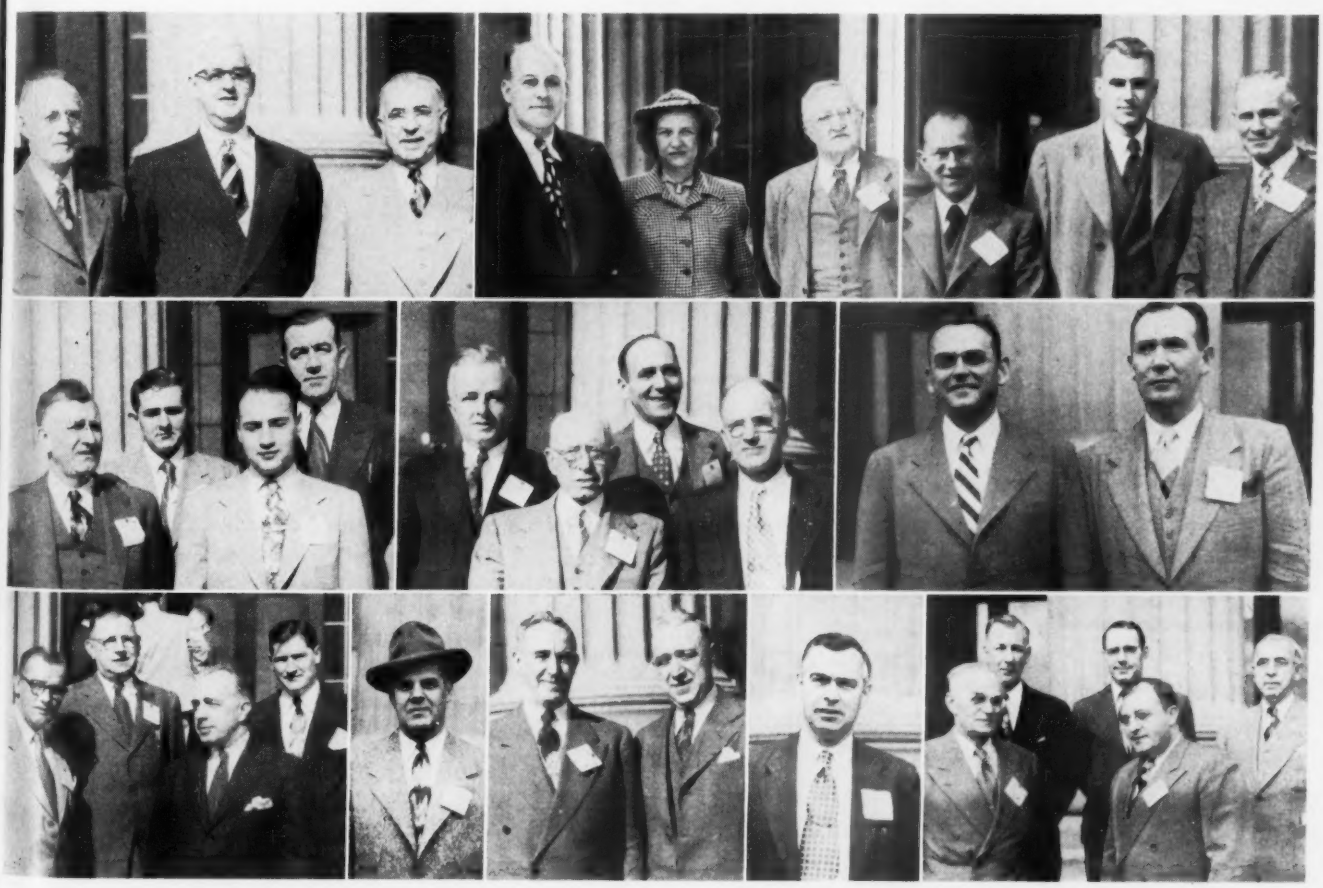

NEW ENGLAND Regional Foundry Conference was held at Massachusetts Institute of Technology, Cambridge, Mass., Oct. 27-28, with over 300 attending. Some of the visitors are shown above. The conference report appeared in the December *Foundry*. Photos by C. A. Wyatt, Debevoise-Anderson Co.

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(*Continued from page* 193)

ture. High hot strength defects also are caused by high moisture content because water has the greatest effect of increasing hot strength. An increase of one-half of 1 per cent moisture will increase the hot strength considerably.

Mr. Barlow continued by discussing high and low strength defects, high and low permeability and high and low flowability, giving causes for each type of defect and outlining remedies.—*Harold R. Wolfer, Puget Sound Naval Shipyard.*

Northwestern Pennsylvania

A REGIONAL meeting at Dunkirk, N. Y. was held Nov. 10 by Northwestern Chapter of the AFS. Meeting place was the Van Buren Bay Inn and J. Marcus Morrison, U. S. Radiator Corp., Dunkirk, N. Y., was chairman.

One of the speakers for the meeting was George F. Watson, chief chemist, American Brake Shoe Co., Mahwah, N. J., who told what the AFS Sand Control Committee is doing in regard to molding and core sands.

NORTHWESTERN PENNSYLVANIA Chapter of the AFS held a regional meeing Nov. 10 at Dunkirk, N. Y. At left, left to right, are: F. P. Volgstadt, Griswold Mfg. Co., Erie, Pa., chapter chairman; G. F. Watson, American Brakeshoe Co., Mahwah, N. J., speaker; Dr. J. M. Dawley, president, New York Teachers Faculty, principal speaker, and J. M. Morrison, U. S. Radiator Co., Dunkirk. Photos by Bailey Herrington, Hickman, Williams & Co.

Principal speaker was Dr. J. Murdock Dawley, president of New York Teachers Faculty and an instructor on the United Nations organization. His subject was "The United Nations and YOU."

Through Dr. Dawley the members of the chapter gained a real insight on the workings of the United Nations. He stated that regardless of the many reverses suffered by the peace-loving world, this organization has substantiated its existence by settling many problems that might have resulted in long warfare in various parts of the world. Years may be necessary to bring to light what has been done to bring all nations together, but it will eventually come about.—*Earl M. Strick, Erie Malleable Iron Co.*

WESTERN MICHIGAN Chapter of the AFS entertained Western Michigan Chapter of the ASM Nov. 6 at the Cottage Inn, Muskegon, Mich. At top, left to right around the table, are: Jack Eurich, Lakey Foundry & Machine Co., Muskegon; William Geisler, Don Rundle, Val Lenar, Bob Lang, Otto Ross and Walter Lack, Campbell, Wyant & Cannon Foundry Co., Muskegon. At bottom, left to right, are: Ross Shaffer, AFS chapter vice chairman; Kenneth W. Haagensen, Allis Chalmers Mfg. Co., Milwaukee, principal speaker; Stanley Davis, AFS chapter chairman; Richard Fox, ASM chapter chairman; Fred DeHudy, AFS chapter assistant secretary, and John Powers, ASM secretary-treasurer. Photos by courtesy of Frank Beethane, Campbell, Wyant & Cannon Foundry Co.

Northeastern Ohio

AT THE Nov. 9 meeting of Northeastern Ohio Chapter of the AFS, held at Tudor Arms Hotel, Cleveland, approximately 250 members and guests heard a discussion on theoretical and practical phases of gating and pouring metal. At a simultaneous session, members of the patternmakers' group were addressed by Walter Sicha, chief, Cleveland Research Division, Aluminum Co. of America. The gating discussion was presented by B. C. Yearley, assistant manager, Chicago Works, National Malleable & Steel Castings Co., Cicero, Ill. The coffee talk, which preceded the technical session, dealt with athletic sporting events, professional and amateur. It was presented by James C. Hendy, managing director of the Cleveland Arena.

In his opening remarks, Mr. Yearley stated that for many years and in some instances up to the present the foundry industry was 80 per cent art and 20 per cent science. In his opinion this condition should be reversed. In the face of active competition from other fabricating meth-

(*Continued on page* 198)

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(*Continued from page* 196)

ods the foundryman should develop practice that will eliminate defects and enable him to guarantee his product. From ease of manipulation and flexibility in design, castings have an advantage. They lose this advantage when they are imperfect.

To eliminate defects, the logical method is to attempt to solve each factor individually. In the present instance the speaker concentrated on two factors—method of gating the mold and pouring the metal. Blackboard sketches were employed freely to illustrate the commentary. Further light was thrown on several controversial points in the question period which followed the formal presentation.

Mr. Sicha addressed the patternmakers on the subject "Heat Treating Aluminum Alloys." He stated that the key to effects of heat treatment is the difference in solubility of the various added elements. Keeping elements such as copper in solution when the metal cools is done by quenching the casting in water.

Solution heat treatment gives a general improvement in properties. Precipitation heat treatment (aging) increases strength and hardness at a sacrifice of elongation. Purpose of the annealing treatment is to obtain a soft material.

In discussing distortion, Mr. Sicha attributed it to four causes: 1. Overheating in machining—if machined hot, the part will be too small when it shrinks on cooling. 2. Bending while machining—because aluminum bends more than iron or steel, machinists must use care in clamping the piece in preparation for working on it. 3. Growth—precipitated material has greater volume than the matrix and greater volume than when in solution. Heating to 400° F or more over a period of time promotes growth. 4. Stresses—surface and inside of casting cool at different rates during quenching, and compression and tension stresses are built up. Machining upsets the balance of these stresses and the part is pulled out of shape when they try to get back in balance.

One of the newer pattern alloys discussed by Mr. Sicha contains 7 per cent copper and 5 per cent silicon. It has good machinability and may be cast with minimum shrinkage.—*Pat Dwyer and Robert H. Herrmann.*

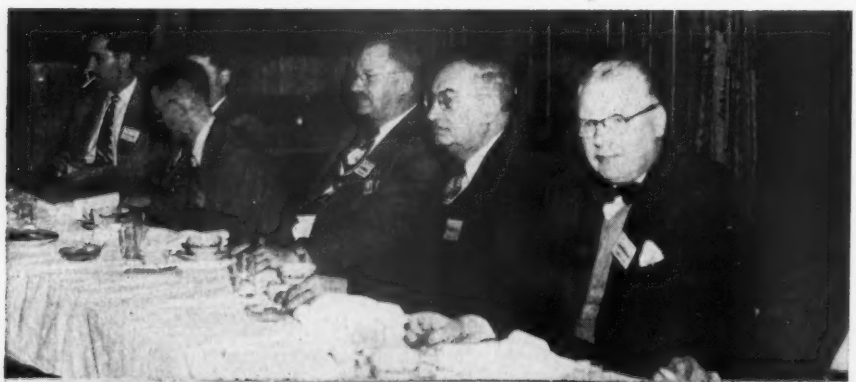
METROPOLITAN Chapter of the AFS met at the Essex House, Newark, N. J., Nov. 6, to hold a foundry clinic with the group of experts pictured here to answer questions submitted by those present. Photo by John Bing, Metropolitan Refractories Corp.

Eastern New York

A TALK on "Brass and Bronze Foundry Practice" was presented by Harry St. John, metallurgist, Crane Co., Chicago, at the Nov. 21 meeting of Eastern New York Chapter of the AFS.

Mr. St. John emphasized general trends in modern foundry practice. He pointed out that several years ago the success of a foundry depended on the personal skill of the workers. However, today it is more a matter of supervision, type and maintenance of equipment. The modern trend includes temperature control equipment, engineered casting design, and maintenance of complete records as absolute necessities. He also stressed the importance of all types of mechanical equipment, automatic molding, cleaning processes and sand control.

Mr. St. John believes that foundrymen should set a high goal which would eventually make available castings of any shape and strength to meet the growing needs of industry. —*George E. Danner, American Locomotive Co.*



EASTERN NEW YORK Chapter of the AFS met Nov. 21. Speakers' table is shown at top. Principal speaker, Harry St. John, metallurgist, Crane Co., Chicago, is second from right. Lower view shows a table group

Metropolitan

A FOUNDRY clinic was featured at the Nov. 6 meeting of Metropolitan Chapter of the AFS held at the Essex House, Newark, N. J., with about 150 members and guests in attendance. James S. Vanick, International Nickel Co. Inc., New York, was discussion leader and the panel of experts included: E. C. Troy, National Engineering Co., Palmyra, N. J.; Mr. Simpson, Eclipse-Pioneer Foundries, Teterboro, N. J.; H. H.

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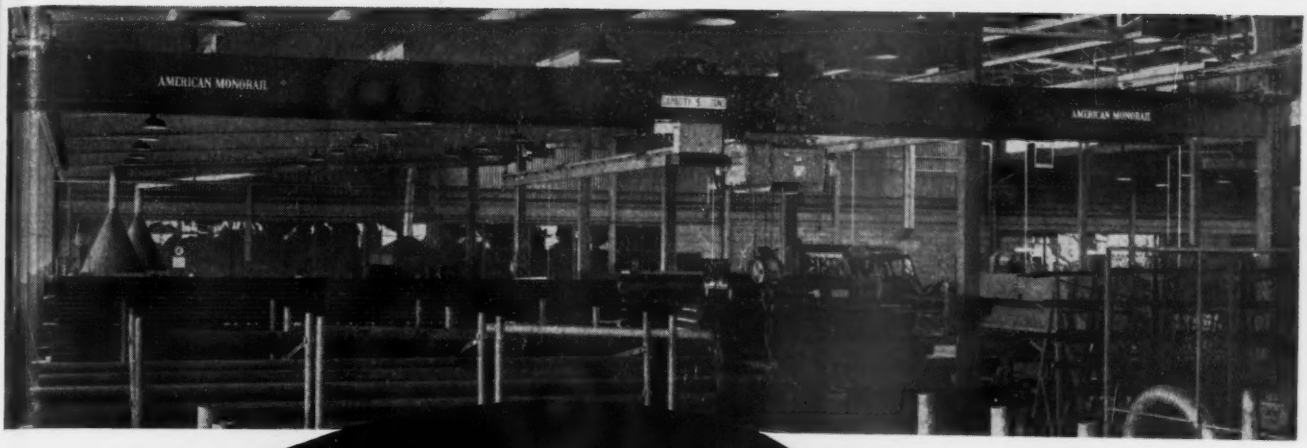

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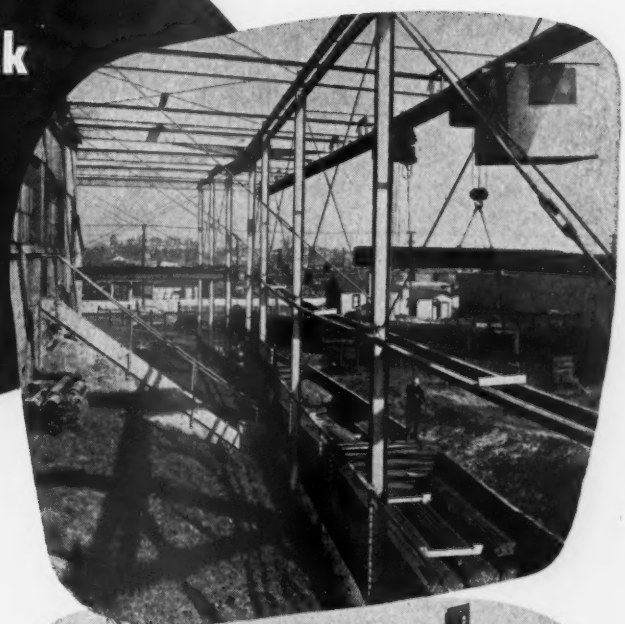

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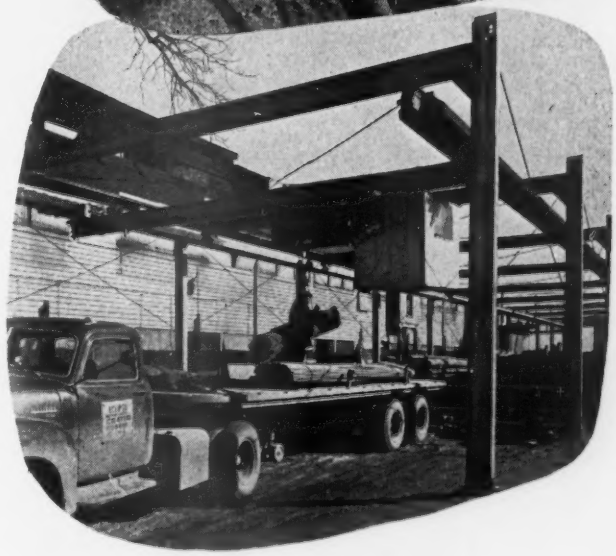

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(*Continued from page* 198)

Kessler, Sorbo-Mat Process Engineers, St. Louis, and R. R. Waltien, New York Naval Shipyard, Brooklyn, N. Y.

Some of the questions asked during the meeting were: Type of inhibitor for use in green sand for No. 220, 10 per cent magnesium-aluminum alloy; effects of cerium on aluminum, chlorine gas on aluminum, sulphur dioxide in molds for magnesium and magnesium-aluminum alloys; degassing of bronzes as well as effects of aluminum, oxides, antimony, etc.; effect of core gases on leaded and other bronzes; effects of tellurium, cadmium and aluminum on gray iron; qualitative effects of inoculants on shrinkage of gray iron; burning through the bed of the cupola, proper coke size, use of extra coke splits; suitable refractories; surface pitting in investment molded stainless steel castings; use of iron oxide in core sand mixtures; drying ladles with wood fires and oil-fired torches; application and purpose of sea-coal in molding sand.—*John Bing, Metropolitan Refractories Corp.*

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Close temperature control with Marshall Thermocouples assures a denser metal with finer grain structure, improved machinability, with less loss of castings due to porosity and other flaws.

Saginaw Valley

A CASTING clinic was arranged for the Nov. 2 meeting of Saginaw Valley Chapter of the AFS, held at the Fisher Hotel, Frankenmuth, Mich. A deluxe chicken dinner was topped off by a coffee talk and movie film by Louis D. McGregor entitled, "Big Game Hunting in British Columbia."

Harry Gravlin, Ford Motor Co., Rouge, foundry, Dearborn, Mich., led a group discussion of defects of castings. Criticism most frequently heard was that there were too few samples on hand for discussion. The local foundrymen requested to furnish these castings claimed that although they tried to furnish samples, it was almost impossible for them to make defective castings in their foundries. —*P. L. Banfield, General Motors Institute.*

Western Michigan

MEMBERS of Western Michigan Chapter of the ASM were invited to attend the Nov. 6 meeting of Western Michigan Chapter of the AFS held at Cottage Inn, Muskegon, Mich., where a smorgasbord followed by a roast turkey dinner was enjoyed by the 109 members present.

Kenneth W. Haagensen, director of public relations, Allis-Chalmers Mfg. Co., West Allis, Wis., presented an outstanding talk entitled "What Kind of a Salesman Are You?" Mr. Haagensen pointed out that we are a nation of "negative propagandists" —always stressing what is *wrong* with our society. In contrast, Russia gives us and the world nothing but "positive propaganda." This "negative propaganda" is carried over into our daily lives—"prices are too high," "our job is no good," "we don't get enough pay," etc.

As an added attraction, A. E. Jacobson, co-partner of Grand Haven Brass Foundry, Grand Haven, Mich., showed color movies and slides of his "Capetown to Cairo Trip." Mr. Jacobson is one of approximately 100 people who have made this trip through the heart of Africa, and his movies and slides are superb.—*C. H. Cousineau*

Southern California

A LARGE crowd attended the Nov. 10 meeting of Southern California Chapter of the AFS held at the Rodger Young Auditorium, Los Angeles, in anticipation of winning the television set raffled off. Success of the raffle can be attributed to Emil Pesche, Reliance Regulator Division, American Meter Co. The set was donated by several foundries and foundry supply houses, and the raffle

raised more than $500 for the new American Foundrymen's Society building fund. Anthony Tuzzolino, Overton Foundry, was the fortunate winning ticket holder.

Tom Barlow, sales manager, Eastern Clay Products Inc., Jackson, O., was guest speaker on the subject "The Fundamentals of Sand Practice." Mr. Barlow emphasized the correct use of sand testing equipment and interpretation of test results for effective sand control. Control measures must begin in the coreroom since the sand distribution there eventually becomes the sand distribution in the molding department.

Mr. Barlow stated that over long periods the most satisfactory method of keeping sand under control is by maintaining curves on its properties, indicating green strength, dry strength, moisture content, permeability, distribution, etc. These curves will indicate trends which may not be discernible from any one day's tests.—*S. L. Jackson, Electro Metallurgical Division.*

Chesapeake

REGULAR meeting of Chesapeake Chapter of the AFS was held at the Baltimore Engineers Club, Oct. 27. Upon completion of chapter business, a roundtable discussion was held on general foundry practice. Three chapter members serving as experts were: Earl J. Bush, Washington Navy Yard; W. H. Holz, American Brake Shoe Co.; and E. W. Horlebein, Gibson & Kirk Co.

A wide range of problems was covered, including types and preparation of mixes of various molding sands, types of core blowing equipment, gating methods, etc. Earl Gaffney, Arlington Bronze & Aluminum Corp., brought in a poorly made aluminum casting and put the problem of correcting the errors to the group. Many solutions were offered and it will be interesting to learn in the future how many were of value. — *Arthur A. Rauchfuss Jr., Penniman & Browne Inc.*

Western New York

EFFECT of the Workmen's Compensation Law on Accident Prevention," by Donald L. Hayes, president, Laverack & Haines Inc., Buffalo, featured the Nov. 3 meeting of Western New York Chapter of the AFS.

Mr. Hayes presented first a history of the safety movement, going back to the year 1910 when most of the benefits to employees were voluntary on the part of the employer. The present New York state law was passed in 1914 and a real advance in safety began.

The speaker emphasized hiring and assigning men according to their mental capacities and giving necessary instructions for the job. He also mentioned the importance of the safety engineer in the plant because his background includes a knowledge of accident cases and the claims involved. In addition, Mr. Hayes pointed out some of the many occupational diseases now compensable under New York state laws which previously were considered diseases of old age or due to natural causes. In conclusion, he stated that a safety program is necessary because the courts have become so liberal that insurance costs are certain to mount unless safety programs are enforced.—*Marve Taublieb, Frederic B. Stevens Inc.*

Reading

TWO speakers were featured at the Nov. 21 meeting of the Reading Foundrymen's Association, held at the Berkshire Hotel, Nov. 21. Bernard H. Ames, New York Naval Shipyard, Brooklyn, N. Y., discussed "Plastic Bonded Shell Molds." Second speaker was Fred W. Hanson, Union

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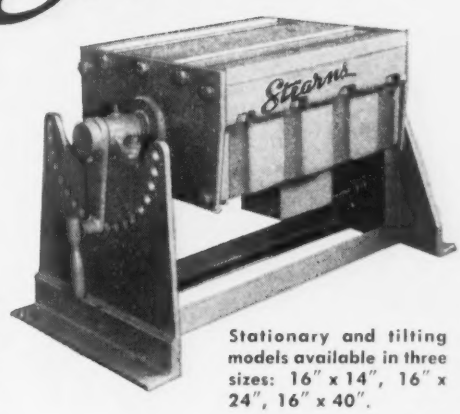

Stationary and tilting models available in three sizes: 16" x 14", 16" x 24", 16" x 40".

YES, here's the answer to new grinding efficiency. Use the STEARNS Grinder Holding Magnet — cut your grinding costs by reducing the set-up time and the grinding time. This means more production, too, for more work is done per man-hour. Easy to install and simple to operate, the STEARNS Grinder Holding Magnet holds all shapes of castings securely and safely. Eliminates the need for clamps, wedges and other devices normally needed for grinding castings.

Using STEARNS Grinder Holding Magnets means savings in dollars and hours, a saving in worker fatigue, and a definite improvement in safety practice.

- CUTS COSTS — Reduces production costs up to 30%.
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Carbide & Carbon Corp., New York, whose topic was "Problems of Iron and Steel Foundries." Following dinner the motion picture film, "Foundry Chills," produced by Fanner Mfg. Co., Cleveland, was shown.

In addition, the following officers were elected to serve for the year 1951: President, George C. Kissell, Fairmount Foundry Co., Hamburg, Pa.; vice president, James S. Hinkley, Dick Bros. Inc., Reading; treasurer, Irwin L. Bossler, American Chain & Cable Co. Inc., Reading; and W. I. Cassidy was re-elected secretary of the organization. Those elected to the executive committee are: Holton Confer, Confer, Smith & Co., Hamburg; Paul B. Harner, Union Mfg. Co., Boyertown, Pa.; Morris McKinney, Dick Bros. Inc.; Paul K. Reiniger, Textile Machine Works, Reading; Clair Snell, Keystone Foundry & Machine Co., Lebanon, Pa.; Arlan L. Wentzel, Birdsboro Steel Foundry & Machine Co. Birdsboro, Pa.; and James Woodward, Excelsior Brass Foundry, Reading.—*W. I. Cassidy, Reading Foundrymen's Association.*

This announcement appears as a matter of record only and under no circumstances is to be construed as an offer to sell or a solicitation of an offer to buy any of these Shares.

NEW ISSUE

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The Penton Publishing Company

$1.50 Cumulative Convertible Class A Stock

($25 Par Value)

Price $25 a Share

and accrued dividends from December 1, 1950

These shares were offered by the Company to the holders of its outstanding 7% Preferred Stock, pursuant to the Exchange Offer set forth in the Prospectus, on the basis of 5½ shares of Class A Stock for each share of 7% Preferred Stock. 72,006 shares were taken by such holders under the Exchange Offer and the remaining shares were purchased by Maynard H. Murch & Co., the Underwriter.

Fulton, Reid & Co.

Successor to

Maynard H. Murch & Co.

December 1, 1950

The Accountant Reports to Management

(*Concluded from page 87*)

year on one page.

Executives of foundries may desire statistical information related to transactions with individual customers (Fig. 13). This can be accomplished by using the same form and method as shown in Fig. 12. The several part or pattern numbers representing the products shipped to the customer are entered on separate lines. This method of reporting is useful to management in observing the profits or losses by part numbers, thus guiding future sales transactions.

The method shown in Fig. 14 of reporting statistical and cost information by cost centers (departments or subdivisions) is extremely useful to management as a controlling instrument.

One set of sheets should record the entire operating activities of the foundry, as well as a set for each cost center.

The method of lapping the sheets for both monthly and quarterly comparisons is explained in Figs. 6 and 7.

By the use of the methods shown herein, the foundry management is in a position to control the activities of the company with minimum effort.

Northwest Conference Draws 135 to Seattle

First regional foundry conference sponsored by the Washington, Oregon, and British Columbia Chapters of the AFS and the College of Engineering, University of Washington, was held at Seattle, Oct. 13-14 with 135 attending.

The conference opened Friday evening with a dinner for foundrymen and their wives at Gowman Hotel. Robert Gregg, Reliance Regulator Division, American Meter Co., Alhambra, Calif., and a national AFS director, introduced William W. Maloney, the secretary-treasurer of the AFS, whose talk was entitled, "What's Ahead for the Foundry Industry."

Leon Morel, Morel Foundry Co., Seattle, also spoke at the dinner, his topic being "An Artist in Bronze." Mr. Morel has produced a number of bronze statuary castings which are located throughout the United States. He pointed out that all of the street light posts in downtown Seattle are of bronze and were produced in his foundry.

Saturday morning and afternoon

technical discussions were held at the university. The group was welcomed by Dr. Bryan T. McMinn, executive officer of the Department of Mechanical Engineering, University of Washington. A paper on "Ductile Cast Iron" was presented by Kenneth L. Clark, International Nickel Co., Los Angeles, which was followed by the showing of the color-sound film, "Fluid Flow in Transparent Molds," produced by the Aluminum and Magnesium Division of AFS. Prof. William A. Snyder, Department of Mechanical Engineering, University of Washington was technical chairman.

A luncheon was held at the university's Union Building at which Stanley Marshall, chairman of the Washington Chapter presided; Prof. Gilbert S. Schaller of the university served as toastmaster, and Dr. H. E. Wessman, dean of the College of Engineering was the speaker.

The afternoon session featured a talk by Michael Bock II, Exomet Inc., Conneaut, O., entitled "The Use of Exothermic Materials as an Aid to Better Feeding," and the paper, "An Approach to Gating from the Standpoint of Hydraulics," presented by Charles Locke, Atlas Foundry & Machine Co., Tacoma, Wash. The meeting was concluded with a visit to the testing laboratory where Dr. Hechtman demonstrated the compression testing of cast iron.

Charles Anderson, Eagle Foundry Co., Seattle, was conference chairman assisted by J. V. Reardon, Federated Metals Division, American Smelting & Refining Co., Seattle; Norman R. Ekholm and Donald Williams, Campbell Hardware Co., Seattle; James Tracy, Salmon Bay Foundry Co., Seattle; Stanley H. Marshall, Atlas Foundry & Machine Co., Tacoma, Wash.; Prof. Gilbert S. Schaller and Prof. William A. Snyder, University of Washington, Seattle; R. N. Tompkins, Western Sand Co., and Fred R. Young, E. A. Wilcox Co., Seattle.

The British Columbia Chapter extended an invitation to the chapters to hold the next Northwest Regional Foundry Conference in Vancouver, B. C.—*Fred R. Young, E. A. Wilcox Co.*

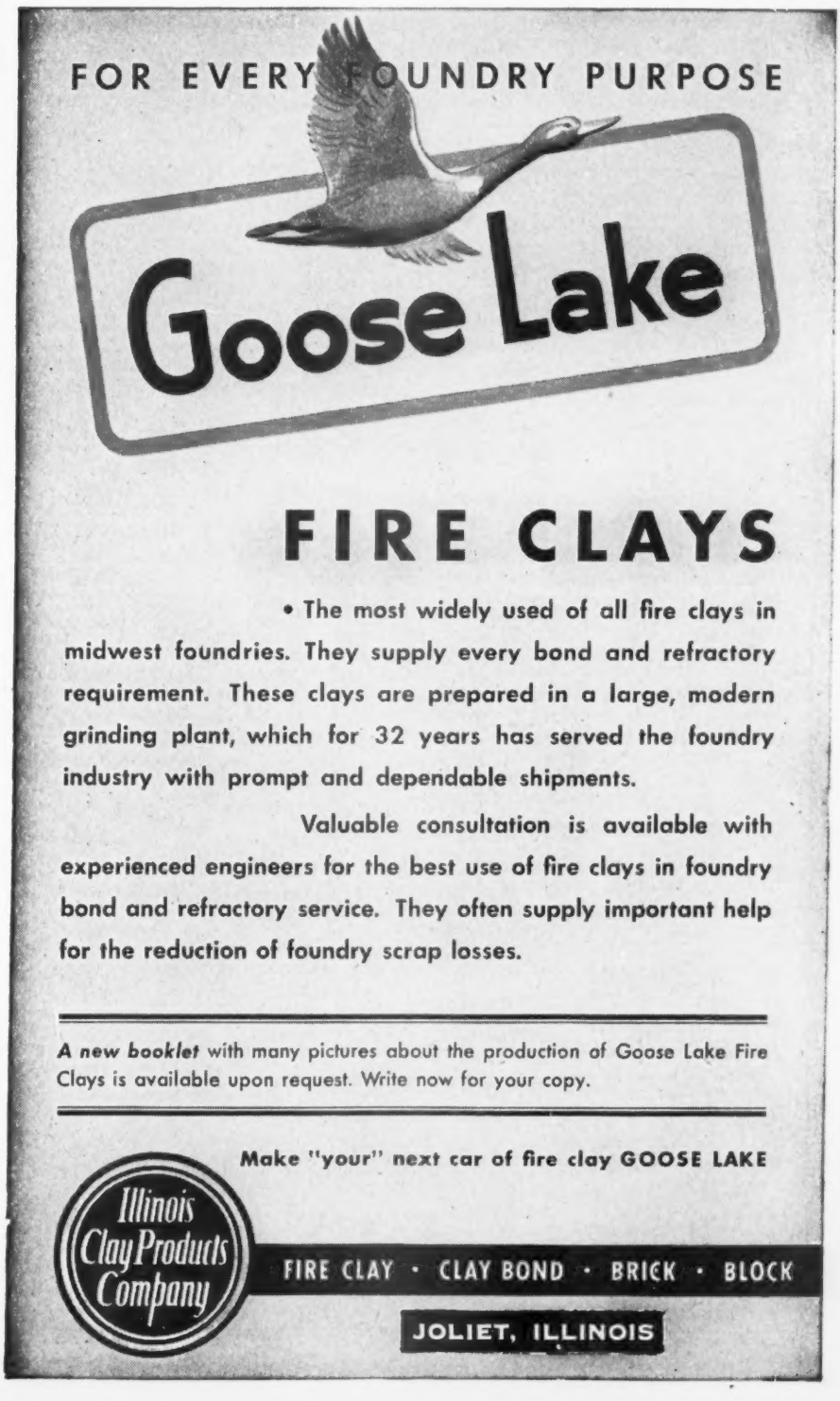
Book Review

ABC of Iron and Steel, edited by Dan Reebel, associate editor of *Steel,* cloth, 423 pages 8¾ x 11¼ in., published by the Penton Publishing Co., Cleveland. Price $10.

About forty years ago, the late A. O. Backert, at that time editor of *Iron Trade Review* (now *Steel*) and later editor of FOUNDRY and president of the Penton Publishing Co., secured the co-operation of a number of outstanding authorities in preparing a series of articles dealing with the processes involved in converting iron ore into finished iron and steel products. These articles were published in a book, *ABC of Iron and Steel.* Interest in the book was so great that four additional revised editions were published between the appearance of the first edition and 1925.

Recognizing the growing need for such a book, the editors of *Steel* again approached leaders in the ferrous metal industries, and a series of entirely new articles was presented in *Steel.* These now have been prepared as 27 chapters in the new *ABC.*

Foundrymen will find particular interest in these chapters: Scrap Iron and Steel, by Edwin C. Barringer; Pig Iron, by B. M. Stubblefield; Open Hearth Steel, by L. F. Reinartz; Bessemer Steel, by H. W. Graham; Electric Furnace Steel, by Walter M. Farnsworth; Gray Iron Castings, by Raymond L. Collier; Malleable Iron Castings, by James H. Lansing; Steel Castings, by Charles W. Briggs, and High Alloy Castings, by W. H. Worrilow.


FOR EVERY FOUNDRY PURPOSE
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FIRE CLAYS
• The most widely used of all fire clays in midwest foundries. They supply every bond and refractory requirement. These clays are prepared in a large, modern grinding plant, which for 32 years has served the foundry industry with prompt and dependable shipments.
Valuable consultation is available with experienced engineers for the best use of fire clays in foundry bond and refractory service. They often supply important help for the reduction of foundry scrap losses.
A new booklet with many pictures about the production of Goose Lake Fire Clays is available upon request. Write now for your copy.
Make "your" next car of fire clay GOOSE LAKE
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JOLIET, ILLINOIS

Adventures of BILL

By PAT DWYER
Illustrations by RICHEY

ANYTHING new, remarkable or startling or even mildly interesting along the social or industrial horizon?" I inquired the other night while Bill toasted his long feet in front of a cheerful wood fire. "I suppose I should have said 'in the offing' instead of along the horizon, but I don't like the word. It is in the same classification as some of the weird abbreviations and word combinations used by a certain newspaper columnist in a pathetic attempt to—as he probably would say—jazz up the remainder of the drivel."

"By a rather peculiar coincidence," Bill said, "you have arrived at the right place at the right time. With your kind permission, and as large a share of your attention as you ever give to any person, any time, I shall read you a copy of an article I came across the other day while browsing through an ancient volume of FOUNDRY. The editor dips his trusty pen into the official inkstand containing a mixture of sulphuric acid, sheep dip and formaldehyde. Then he proceeds to calmly remove the hide from a member of the reporting fraternity and hang it still quivering on the door of the old red barn. Drastic action on the part of Ye Ed was prompted by a newspaper story covering the experience of a reporter in a foundry. Are you all set? Here's the pitch. Here she comes!

Well sir, there's no use talking. It takes the common average everyday newspaper reporter to write the most intensely accurate and interesting article on what goes on inside a foundry. Practical foundrymen are so familiar with every detail of foundry operation that the whole business is extremely commonplace. Naturally and consequently they lack the exuberant enthusiasm that always seems to possess newspaper reporters or the high-class boys who spread themselves in the smooth paper magazines, as soon as they get into a foundry.

The average reporter is about as bright as they make 'em when dealing with questions that pertain to general society. When he essays to tell what he saw in a foundry, it is then, ladies and gentlemen, that he rises to supreme stature as a purveyor of news. Real red-hot scintillating stuff right off the griddle. Without the least shadow of doubt his thrilling story is entirely new to the general public. Certainly a great deal of it is simon pure news to any foundry reader.

"As far back as I can remember," I interrupted Bill, "that type of story turns up now and again. Sometimes I wonder whether they are genuinely naive productions, or the brain children of some foundry wag with a peculiar and distorted sense of humor. I do not claim to be a prophet or the son of a prophet, but I am willing to bet any reasonable amount up to say two bits, that I can touch on the main points in the present story."

"Have you ever seen, heard or read of upside down parting sand?"

"Are you still on the main line, or have you run through an open switch into a tangle of brush, raspberry bushes and poison ivy? What's the grand idea of dragging in this upside down parting sand?"

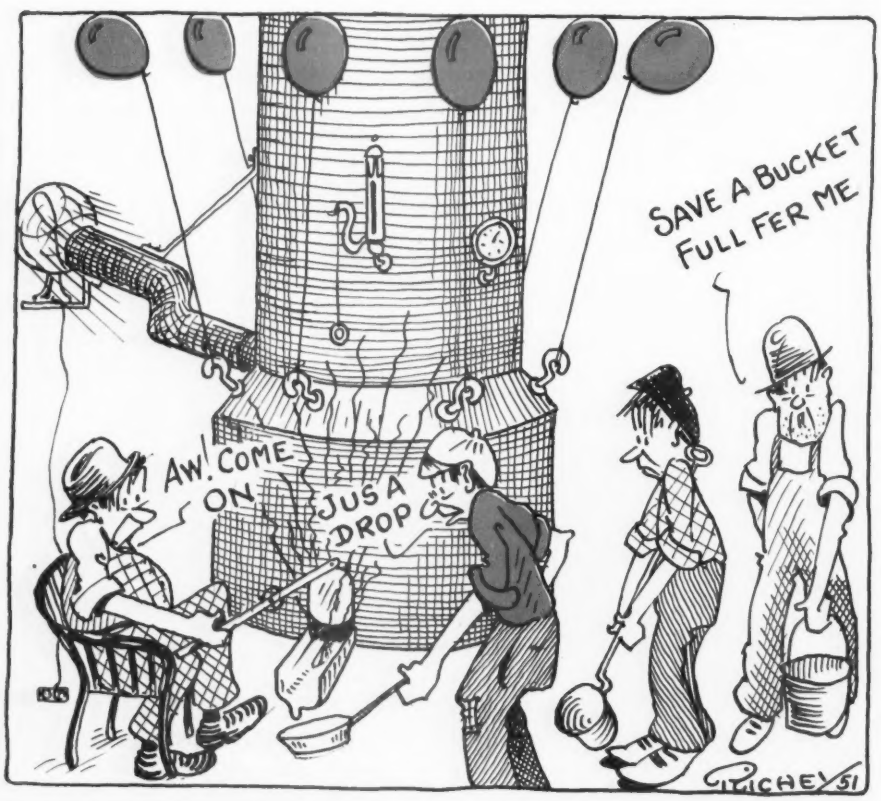
"As you were." Bill calmly raised one hand in the gesture of peace practiced among the Indians and the more advanced members of the Boy Scouts. "Pipe down. You ain't heard nothin' yet. And you may as well hand over the two bits. Le's see. Where did I leave off?"

A reporter visited a prominent foundry in an East coast city the other day and wrote a two-column article about it for his paper. The story was ornamented with a generous size illustration of a section of the foundry with the cupola in operation. Even a quick look at the picture would make any foundryman uncomfortable to put it mildly. The huge flasks evidently are made of steel bridge channel beams, or 16 x 16 in. square timbers, probably fashioned in the days when Paul Bunyan, his blue ox Babe and his bully boys and white water burlers were logging this section of the country.

One man in front of the spout is shown catching iron in a hand ladle. Another standing about 4 ft away apparently intends to follow, while three other men, disinterested spectators, stand at a distance with empty hands. No sign of a cupola tender waiting to stop up after the hand ladles are filled. And if all this were not enough, the artist has connected the wind pipes from a weird type blower to each side of the cupola spout! Lacking other evidence one is forced to the conclusion that the cupola is suspended from the roof. It has no legs or other support from below.

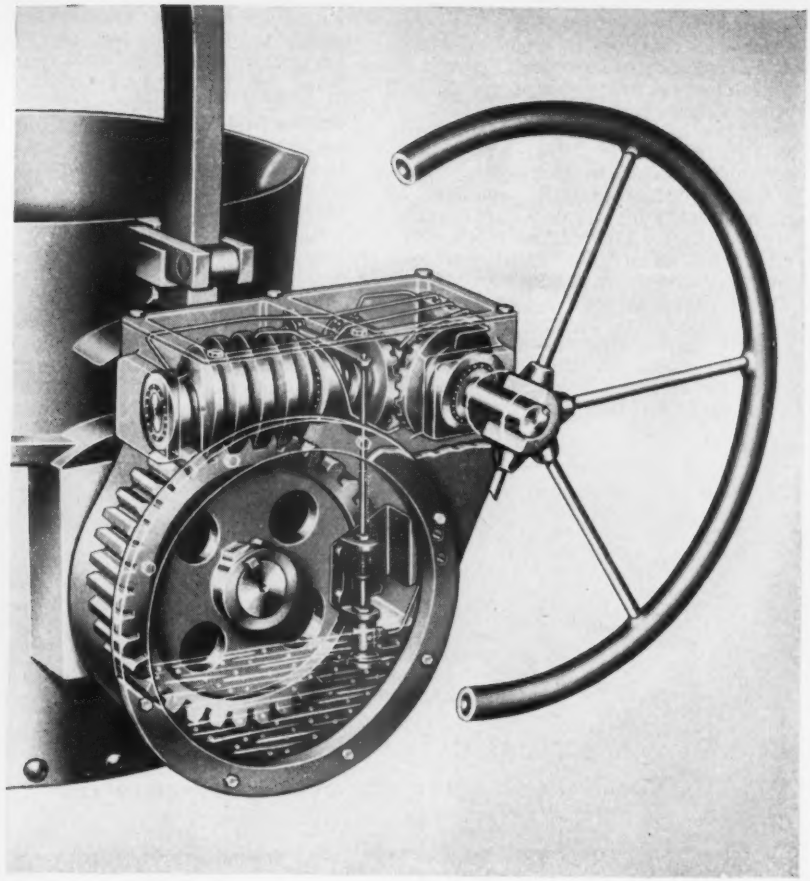
Description of the molding process is a fine example of the outside and highly trained viewpoint. The pattern is laid upon the sand and leaves an impression there so accurate that it looks like something carved in black marble. The man who is making the casting pours a little water here and there and dusts the sand over with lampblack, two things nec-

(*Continued on page* 206)



Foundry herewith shows first view of astounding new type cupola

New Worm Ladle Gearing ELIMINATES GASKET ADJUSTMENTS



. . . WORM AND BEVEL GEAR ASSEMBLY COMPLETELY ADJUSTABLE

Here is another Industrial Equipment Company first . . . new, improved worm ladle gearing bringing *complete universal adjustability.*

Take a close look at the phantom view. Here is a one-piece, self-contained unit with all parts easily accessible. Your maintenance man can quickly make back-lash adjustments to pin-point accuracy and positive adjustment by adjusting the bearing lock nuts on all gears and worm. These nuts are easily reached and with working space to spare.

Unaffected by Heat

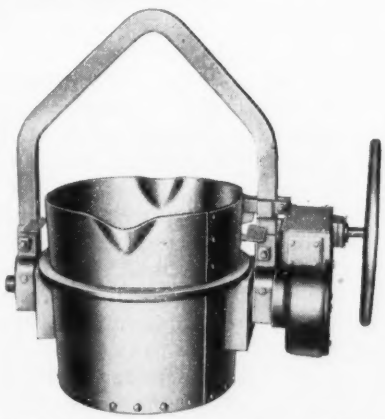
There is no connection between the bail and the gearing. No clearance for heat distortion is necessary, permitting an assembly almost to machine tool precision.

Industrial's new gearing is absolutely safe and positively self locking. The high ratio between worm and worm gear locks the ladle in any position. Incidentally, worm and bevel gears are of high tensile semi-steel and the worm is of high alloy steel. All are precision cut. Shafts are mounted on anti-friction bearings.

Now Standard Equipment

All Industrial geared ladles are now supplied with this outstanding new type of gearing. In addition, this gearing can be supplied for any Industrial worm geared ladles now in operation. *Write for details.*

- **Completely enclosed and self contained**
- **Automatic force-feed lubrication**
- **Positively self locking in any position**
- **Precision cut gears**



Model 592T ladle with new type gearing. Also notice use of Industrial Equipment's much talked-about UNIVERSAL BAIL. This bail completely eliminates binding due to heat distortion or misalignment. Rigid bail also available.

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LADLES • BOWLS • SHANKS • BAILS • TONGS • SPECIAL EQUIPMENT

(*Continued from page* 204)

essary to make a good casting.

No iron or steel works story is complete without reference to the brawny puddler. Our hero, true to traditons of the craft, brings him in at this point. The keen eye misses nothing. Listen to this:

The third assistant puddler is shown throwing fistfulls of parting sand over the face of the mold. Replying to an inquiry from your reporter this highly skilled artisan stated that this was one of the most important items in the complicated process involved in the molding procedure. Clean, white sand from a carefully selected section of a bathing beach on the harbor (in local parlance "habah") front is lifted by either the right or left hand from a bucket or other suitable container, wood or metal, and thrown by a wide arm movement over the mold. The action is reminiscent of an illustration in the ancient parable of the husbandman who went out to sow the seed. Amount of material, trajectory and line of flight are important items, but the most important feature is throwing the sand in such a manner that it will come to rest *right side up* on the face of the mold.

We were assured this is one of the most closely guarded secrets in the molder's bag of tricks. It is the last item imparted to an apprentice on the night he completes his apprenticeship period and is initiated into the Union. Occasionally a member has been known to divulge certain secrets, but up to the present none of the swarthy brethren has been guilty of exposing to the public this flick-o-the-wrist technique. We felt highly complimented by the implied confidence in our discretion.

When the reporter leaves the realm of technics and settles down to the portrayal of generalities he shows the real mettle of his makeup, and it is pretty good mettle too.

Without meaning any disrespect to the men who pour the iron, it may be said that the scene in the half-lighted room where fire is running around like water and is being poured here and there by the workers whose faces are black with the dust, strikingly suggests the orthodox ideas of the regions in the world beneath. City people pay a dollar and a half for a seat in a theater where they marvel at the realistic scene with its red fire and lightning when Faust views the Brocken.

Every day in the year there are much more exciting scenes in the foundry in which fire plays a principal part and brawny puddlers handle it as easily and nonchalantly as the milkman handles milk. The ordinary iron foundry in its daily routine makes stage realism tame and commonplace.

"My only regret," Bill said as he folded the paper and threw it into the fire, "is that I did not read the article several months ago. It would have been of great help to me in diagnosing a problem submitted by a nonferrous foundryman. Small castings sent for examination were dirty and warty and bore a strong resemblance to some of the more repulsive illustrations in medical journals dealing with leprosy. In the light of this recent amazing discovery I could have informed my correspondent that undoubtedly his trouble was caused by sprinkling parting sand on the mold upside down.

"He wrote me that he was sending two sample castings poured from yellow brass ingot metal, melted in an oil-fired furnace and poured at a temperature between 2000 and 2100 F. Thin castings have a clean smooth surface, but castings with thicker sections invariably present an ugly rough surface, usually on the cope side and principally in the vicinity of the gates. He had tried various suggestions to eliminate this condition, but without success. He even tried a block of wood at the lip of the crucible to prevent slag from entering the mold.

"I wrote him that, basing an opinion on the appearance of the castings, I hesitated to offer advice. First, because it might hurt his feelings—and I have a conscientious objection to hurting any person's feelings. Second, because the necessary advice

They RESIST WARPAGE

. . . it's less than 0.1%

Transite Core Plates offer all these advantages:

They speed production

Core makers save trips... handle many plates at one time.

They last longer

Made of fibrous asbestos and cement, Transite Core Plates resist shock...are less likely to crack or break.

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Core wash, sand, etc., do not stick as readily as to other materials. Both sides are usable.

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Transite Core Plate surfaces stay smooth even after long service. Warpage is less than 0.1%.

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Low price, low maintenance and long life add up to low cost.

To eliminate green cores and reduce baking time perforated plates are also available.

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Johns-Manville

would be on a par with and about as useless as trying to explain calculus and higher mathematics to a boy doing first grade work. In the foundry the comparison usually is described as trying to teach your grandmother how to shoot snipes with a bow and arrow. With the exception of the dirty area on the cope side, one casting was fairly passable. The other was only fit to go back into the melting pot. The castings had every appearance of having been made by a person without any molding skill or experience.

"The second casting might be gated at any convenient point, so far as filling the mold is concerned. A sense of technical propriety developed through training and experience would induce a skilled molder to arrange the group of patterns in position to be gated at one end. In addition to the symmetrical appearance, this arrangement would permit the metal to fill both legs of the casting simultaneously. This feature is not as important on small castings as it is on large castings, but it is one of the small things that mark the professional from the amateur. The flash metal all around the joint indicates that either the halves of the pattern did not match properly, or that the cope shifted on account of loose pins or careless clamping.

"A small lump of brass takes the place of sand at the lower end of a deep lift. If the sand failed to come up with the cope, or if it fell off before the mold was closed, it would not be a factor of major importance, outside of indicating sloppy performance. If it was crushed or fell off after the mold was closed, this floating bit of sand would result in a defective spot on the casting, irrespective of whether it retained its full shape and bulk or disintegrated.

"Yellow brass especially when *needled* with a little aluminum—about 2 oz to 100 lb of metal—is more fluid than many other alloys. The slag also is more fluid. Extra precaution must be taken to prevent entrance of this slag with the metal. Before starting to pour, the metal in the pot is stirred vigorously with the skimmer, or with a plain, straight rod to bring any entrained slag to the surface. A handful of sand thrown on the surface will help to cool and coagulate the slag film where it may be held in place with the skimmer. A strainer core at the bottom of the sprue is designed to catch any slag that passes the lip of the crucible. This extended reference to slag is due to the fact that the main defects on both castings are caused by slag that floated in with the metal. This readily may be detected through even a low power microscope."

"In regard to the sand thrown on the metal in the pot," I ventured, "and in the light of your recent knowledge, would you advise a high or low pitch, or a curved delivery? It seems to me that point needs a little more attention."

"No possibility of making a mistake," Bill admitted judicially. "Old molding sand, according to the best authorities, is the same on both sides!"

Honors Veteran Employees

Eleven employees of National Malleable & Steel Castings Co., Cleveland, received gold watches in recognition of thirty years of service with the company at a dinner sponsored by the company's service society, Oct. 21, at Tudor Arms Hotel. Those honored were: Albert Buckius, Harry Doggett, Felyks Fialkowski, Edward Fisher, Tom Heffner, Carrie Hulsmeier, Anton Kopta, Rose Lukacs, Arthur Meriweather, Paul Toth and Peter Rubienski.

Induction melting furnace
Electrically heated launder
Induction holding and pumping unit
Pump nozzle
Cold chamber of die casting machine

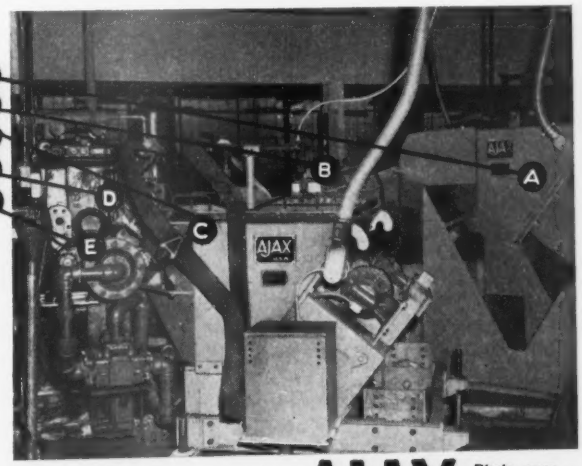


Photo courtesy Scintilla Magneto Div., Bendix Aviation Corp.

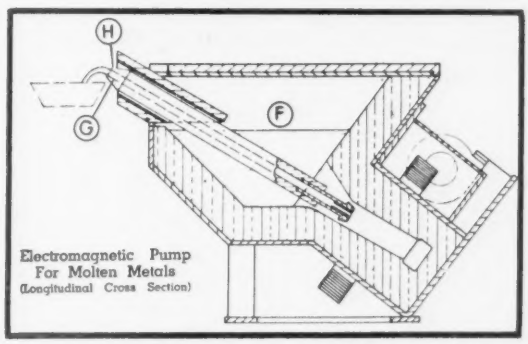
Streamlined Molten Metal Supply by AJAX

NO HAND LADLING

Once the metal is in this AJAX furnace, no further attention is necessary . . . no checking for temperature or timing. An electromagnetic pump (connected with an automatic timer and with the controls of the casting machine) discharges a predetermined weight of metal at precise and regular intervals. This method averages 25% greater output of acceptable castings over that of hand ladling.

In the induction pump (diagram at right) the metal level in the nozzle (G), while idling, is held at all times near the opening (H) and high above the level (F) in the furnace. Thus oxidation in the tube is prevented. When pumping, the molten metal travels only a very short distance, and each shot is completed swiftly.

CONTINOUS AUTOMATIC OPERATION OF DIE CASTING MACHINES



Electromagnetic Pump For Molten Metals
(Longitudinal Cross Section)

Diagram above taken from "Liquid Metals Handbook" published by Atomic Energy Commission

AJAX ENGINEERING CORPORATION, Trenton 7, N. J.

AJAX TAMA-WYATT

INDUCTION MELTING FURNACE

AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., INC., The Ajax Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax Wyatt Induction Furnaces for Melting

New EQUIPMENT *and Supplies*

For Additional Information on these Items Use Reply Card—Page 211

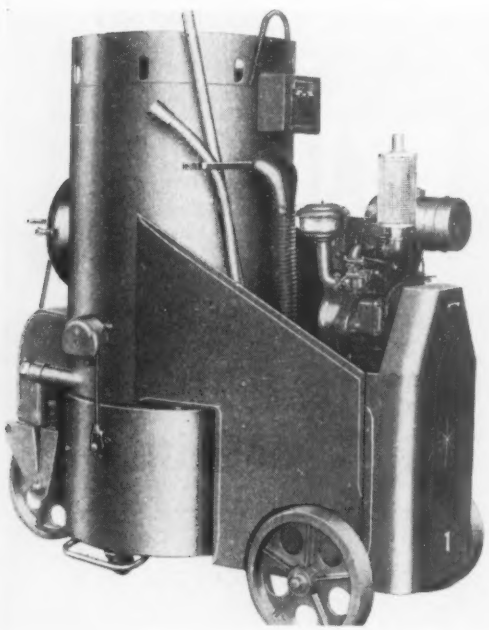
(1)—Vacuum Cleaner: U. S. Hoffman Machinery Corp., Air Appliance Division, 105 Fourth Ave., New York 3 — Industrial vacuum cleaner is powered by a four-cycle, single cylinder, air-cooled, gasoline engine rated at 6.8 hp. It is equipped with a flame-arrestor type muffler. V-belt drive connects with a multi-stage centrifugal exhauster. Cleaner is designed for simultaneous operation of two 50-ft lines of 1½-in. hose. For single sweeper use, one 75 or 100-ft length of 2-in. hose can be operated. Dust container has 7½-cu ft capacity. An electrically powered cleaner, identical in other respects, also is offered.

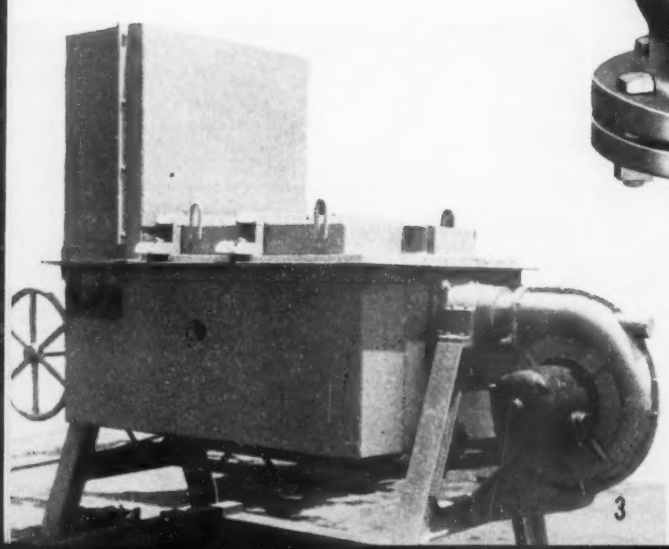
For More Details Circle No. 1—Page 211

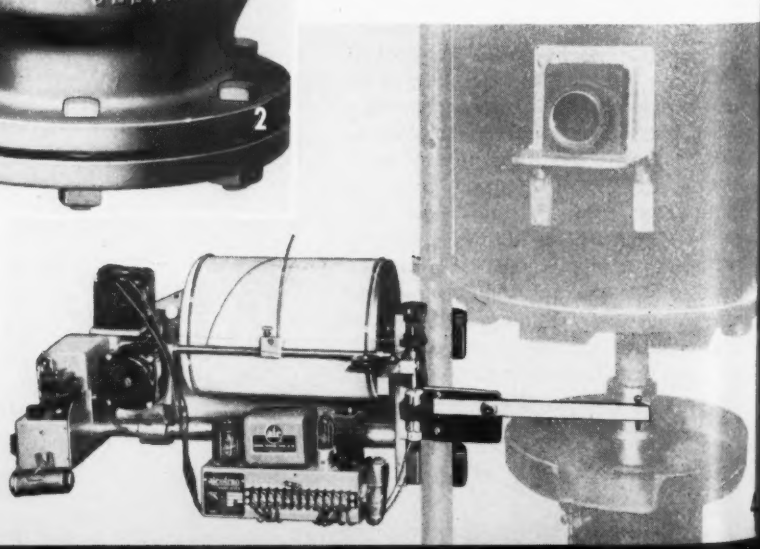
(2)—Air Cleaner: Swartwout Co., 18511 Euclid Ave., Cleveland 12 —Separators for cleaning compressed air by centrifugal force are available in seven inlet and outlet tapping sizes, from ½-in. to 2½-in. Units are said to remove 99 per cent or more of all impurities from compressed air without pressure drop. Moisture, oil, scale and other solids in the air are whirled outward to the walls of the unit where they drain down to the trap section. At the same time the clean, dry air passes unimpeded to feed line or tool. A float-operated trap automatically releases accumulated liquids as they rise to a level above that necessary to effect a seal. Drain valve outlet is tapered to prevent stoppage by particles or scale.

For More Details Circle No. 2—Page 211

(3)—Furnace: Reda Pump Co., Bartlesville, Okla.—New gas-fired furnace for melting gray iron, brass or bronze is said to require no work before starting; it is simply fired up and melting begun. It is designed to provide good mixing action for alloy melting and to be quiet in operation. Field operation in a gray iron foundry showed the following performance: 400-lb charges were melted in an average time of 24 minutes per heat (51 minutes for first heat and 19 minutes for the eighth). Minimum tap temperature was 2850° F. Average consumption of 1000 Btu gas per heat was 2400 cu ft, and metal was melted at a cost of $2.40 per ton with gas costing 20 cents per 1000 cu ft. An average of 300 heats were obtained per furnace lining. In a nonferrous foundry, 425-lb heats of bronze were melted in an average of 13 minutes (27 minutes first heat







and 11 minutes on later heats). Minimum tap temperature was 1975° F and maximum, 2350° F. Average gas consumption per heat was 1100 cu ft and melting cost per ton was $1.035 with gas costing 20 cents per 1000 cu ft. Over 300 heats were produced with one furnace lining, and no excessive lining wear was observed. Company estimates that one lining will produce 1000 heats.

For More Details Circle No. 3—Page 211

(4)—Sand Deformation: Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4—Instrument is designed to measure deformation of hot sand, and is intended for use with any model of the company's dilatometers. The instrument also is available as an indicating model. The unit is said to be useful in helping to develop a molding sand with sufficient plasticity to allow expansion to be taken up in grain-to-grain contacts and thus avoid ruptures in the mold face.

For More Details Circle No. 4—Page 211

Copper Shot: Metals Disintegrating Co., P. O. Box 290, Elizabeth, N. J.—Copper cleaning shot for all types of nonferrous castings and pieces cleans by the force of its impact, yet does not imbed itself, it is claimed. Shot can be used either in air or wheel type machines. While designed specifically for the nonferrous casting trade, it also is applicable to all types of cleaning and finishing where a light finish is desired. The shot is made from copper wire and is in the form of cylinders; length of each cylinder being equal to its diameter.

For More Details Circle No. 5—Page 211

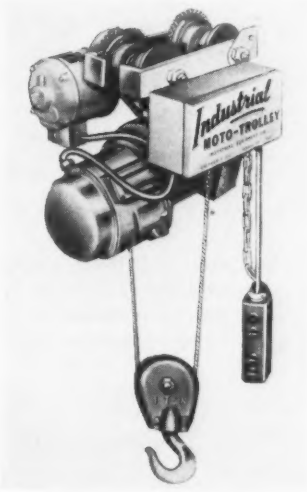
Washfountains: Bradley Washfountain Co., North 22nd and West Michigan Sts., Milwaukee 1—Company precast marble and stone washfountains now are available with metal pedestals. Because of their lighter weight the new pedestals offer savings in freight costs and also are easier to handle on the job. Convenience of installation and later maintenance are possible because the panels of the pedestals are removable, providing ready access to mechanism within.

For More Details Circle No. 6—Page 211

Air Vises: Van Products Co., 2158 Baldwin Bldg., Erie, Pa.—Air-operated vises now are offered with interchangeable jaw faces of hardened tool steel with serrated or smooth surfaces. Vises are operated on 15 to 150-lb air pressure. Pressure exerted by the jaws is 50 times air line pressure.

For More Details Circle No. 7—Page 211

Power Trolley: Industrial Equipment Co., 315 North Ada St., Chicago 7—Motor-driven trolley is designed for attachment to standard lug-mounted electric hoists and may be adjusted to accommodate a wide



variety of beam sizes. Unit is powered by a crane duty, high-torque, totally enclosed motor of 30-minute, 55-degree rating. The magnetic contact panel is equipped with a transformer to reduce the voltage in the single-speed pushbutton control circuit. A four-button control station is provided to operate the single-speed trolley and hoist motions.

For More Details Circle No. 8—Page 211

Fork Truck: Baker Industrial Truck Division, Baker-Raulang Co., Cleveland 2—Center control fork truck in 5000 and 6000-lb capacities has initial lift of 61 in., telescoping lift of 126 in., and will make a right angle turn in 98 in. plus length of load. Truck is electrically driven. Lift and tilt mechanism is hydraulically operated and employs a low pressure hydraulic system for safety, positive control, and low maintenance. Operator sits on left side of vehicle and has an unobstructed view of the end of the forks when engaging a load, it is claimed. No chains are in the operator's line of vision with the load in the normal traveling position. Travel is selected by a manual control on the dash panel, and speed is selected by a five-speed foot-operated accelerator. An electrical interlock with the brake and the seat provides dead man control. Dynamic braking provides safety when descending ramps and saves wear on the service brake. An air-cooled drum-type mechanical brake is mounted on the motor shaft.

For More Details Circle No. 9—Page 211

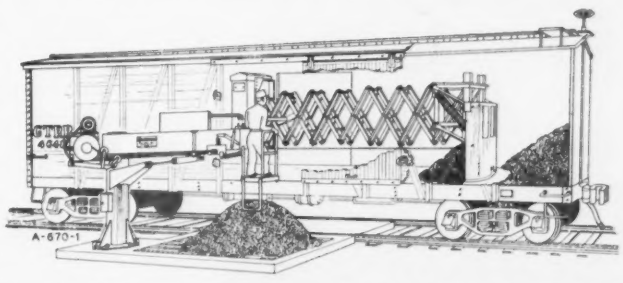
Impregnated Gloves: American Rubberizing Co., 617 Eleventh Ave., South Minneapolis, Minn.—Plastic impregnated gloves are said to have good wear-resistant qualities, to be waterproof and snag-proof, and heat and flame resistant. Additional features claimed are superior tensile and tear strength and high abrasion, acid, and alkali resistance.

For More Details Circle No. 10—Page 211

Tramrail Electrification: Forker Corp., 2083 Random Rd., Cleveland 16—Tramrail and crane shielded electrification system for three-phase operation with capacities to 600 v at 75 amp is designed to reduce arcing and flashing of conductor bars by use of large area shoe contacts with individual springs in each shoe. Installed directly below the tramrail track tread the conductor bar has a 16-gage sheet metal housing to shield conductor bars from the top and two sides. Insulated conductor bars are of copper-bearing mild steel and have the same coefficient of expansion as the steel tramrail track.

(*Continued on page* 210)

Pantograph Box Car Unloader Handles Bulk Materials



Stephens-Adamson Mfg. Co., 100 Ridgeway Ave., Aurora, Ill.—Box car unloader handles bulk materials, up to 2-in. lump size. Pantograph arm equipped with a scoop reaches into the car until it meets an obstruction, drops down and withdraws a load of material, discharging it to a track-side hopper. This cycle continues automatically, the single operator taking only enough time to direct the arm to different sections of the car. A brush attachment snaps to the scoop for final cleaning of the car. Unloader occupies an area 5 ft 6 in. x 14 ft 2 in. when not in use and requires a single concrete footing for mounting.

For More Details Circle No. 11—Page 211

(*Continued from page* 209)

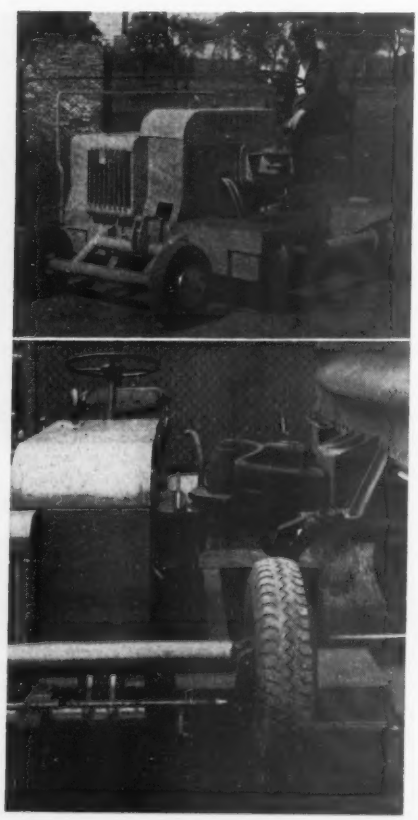
The trolley current collector is located in a protected position inside the trolley yoke. Shielded electrification systems are factory fabricated in 10-ft lengths for erection on the job.

For More Details Circle No. 12—Page 211

Refractory: Babcock & Wilcox Co., Refractories Division, 85 Liberty St., New York 6—New refractory for lining higher temperature furnaces is produced from a base of mullite. Company claims that the refractory will not melt until it is heated to more than 3300° F; also that when heated to 3000° F a firebrick of the material will support 1000 lb without deforming and when successively heated to 2550° F and sprayed with cold water a dozen times, will show no cracking or chipping. The material is manufactured in the form of firebrick principally, but also is available as grain and ramming mixes.

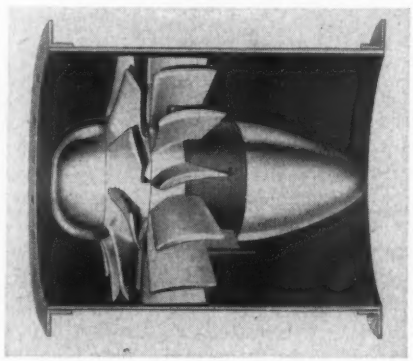
For More Details Circle No. 13—Page 211

Car Mover: Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.—Compact unit for moving freight cars is powered by a 60-hp gasoline engine and will travel on a railway track or on the ground. The unit couples to any standard railway car. When coupled, a hydraulic jack in the unit raises the coupler, forcing the Trackmobile down on the track, and enabling it to develop a maximum draw-bar pull of 7350 lb. Machine uses four standard AAR steel wheels for track travel. The four rubber-tired wheels for ground travel are hydraulically retracted when the machine is positioned for track operation. It is claimed that one operator can transfer from one set of wheels to the other in 30 seconds. Machine weighs 6000 lb and has a maximum ground speed of 20 mph and track speed which varies with the load. Transmission provides four speeds ahead and reverse, with standard automotive type selective shifting.



For More Details Circle No. 14—Page 211

Vaneaxial Fans: Robbins & Myers Inc., 1345 Lagonda Ave., Springfield 99, O.—Vaneaxial type, medium pressure, propeller fans are



designed for ductwork applications with series or straight-through connections for all air moving requirements. Supplementing aerodynamically-engineered airfoil section propellers, the guide vanes prevent swirling and provide a smooth, efficient, axial flow of air. Positioned directly behind the propeller, the vanes are mounted independent of the welded steel drum. Spun aluminum nose and tail cone, providing the functions of streamlining the air flow, are contained within the distance between the two mounting flanges of a 30-in. duct section. Said to be easily installed in standard 20 and 24-in. diam duct systems, the units are equipped with open ventilated, ball bearing, 40° C rise, standard NEMA foot-mounted motors. Fans are available in two models—one constructed with the motor inside the airstream, suitable for non-hazardous applications; the other is recommended for installations in which corrosive or inflammable fumes, dusts, or vapors must be considered.

For More Details Circle No. 15—Page 211

Glove Reconditioning: U. S. Industrial Glove Corp., 9350 Roselawn Ave., Detroit 4—Work glove reconditioning service includes complete renovation, sanitizing and packaging of all types of worn-out fabric and leather gloves and protective clothing. Special equipment and methods have been developed for performing the operations. It is claimed

that salvage averaged 83.9 per cent on a study involving over 1 million gloves of every type from a variety of industries. A free trial plan is available.

For More Details Circle No. 16—Page 211

Hoists: Shaw-Box Crane & Hoist Division, Manning, Maxwell & Moore Inc., 414 Broadway, Muskegon, Mich.—Chain block of 1-ton capacity utilizes splines instead of keys, a new conception of a load brake that is said to make lowering easier and faster. Hoist weighs 42 lb. Frame and covers are aluminum alloy, and chain, gearing and shafts are heat treated steel. Company's new 1-ton electric cable hoist is pushbutton controlled with only 24 v at the buttons. Main frame is steel, and housings and covers are aluminum alloy. New motor brake is of the multiple disk type with the friction disks operating in oil. Motor mounting will receive any standard make of motor with a NEMA flange mounting. Hoist is available for lug suspension, standard push geared type, and motor driven trolleys, and for all standard electric currents.

For More Details Circle No. 17—Page 211

Vibrator: Cleveland Vibrator Co., 2788 Clinton Ave., Cleveland — Redesign of the company's "F" model vibrator has reduced the number of major parts to five. The simplified design is said to present advantages in maintenance, wear, and operation. This vibrator is designed to reduce plugging and arching of bulk materials in chutes, hoppers, bins, screens or storage tanks.

For More Details Circle No. 18—Page 211

Air Line Filter: A. Schrader's Son Division, Scovill Mfg. Co., 470 Vanderbilt Ave., Brooklyn 17, N. Y.—Air line filter features a filtering element composed of hundreds of laminations of a fine, newly developed

(*Continued on page* 213)

HELPFUL LITERATURE

50. Polishing Abrasive

Simonds Abrasive Co.—4-page illustrated bulletin ESA-198 describes Borolon aluminum oxide abrasive grain for polishing operations. It is triple tested for grain size, capillary rise and grain shape. Recommendations are made for typical polishing operations.

51. Belt Conveyors

Industrial Engineering & Mfg. Co.—2-page illustrated data sheet "Universal Industrial Conveyors" describes 12-in. width belt conveyors which are available in lengths of 8, 12, 16, 20 and 24 ft and which have maximum elevations ranging from 5-2/3 to 16-2/3 ft respectively. These portable units are powered by electric motors.

52. Oil Burners

Hauck Mfg. Co.—8-page illustrated catalog No. 456 features Venturi high pressure atomizing oil burners for high-velocity multiple-port atomization of oil. Cylindrical, conical and flat flame types are depicted. Unit utilizes compressed air or steam as atomizing agent at pressures ranging from 30 to 150 psi.

53. Materials Handling

Clark Equipment Co., Industrial Truck Div.—8-page illustrated form TC-44 is condensed catalog containing basic specifications of entire line of materials handling equipment. Listed are gas-powered and electric fork lift trucks on solid or pneumatic tires, industrial towing tractors, Tructractor models for handling bulk materials and twenty special attachments for particular uses.

54. Melting Furnaces

Pittsburgh Lectromelt Furnace Corp.—64-page illustrated catalog No. 7 discusses standard sizes of electric melting furnaces in capacities from 25 lb to 100 tons and gives data relative to each type and size. Furnaces are designed for melting and refining of iron, steel, nickel and copper.

55. Core Ovens

Foundry Equipment Co.—8-page illustrated bulletin 206 gives data on Coleman shelf-type and rolling-drawer portable core ovens. Gas, oil or electric recirculating heating systems can be supplied. Ovens provide fast baking, continuous operation and low fuel consumption.

56. Production Grinding

Minnesota Mining & Mfg. Co.—36-page illustrated manual "Step Up Production" is second volume in series which gives information on mechanical application of coated abrasives for industrial grinding and finishing. Several actual finishing operations are shown and details are given. Tools which utilize abrasive belts are described, and data are given on available accessories.

57. Clamshell Buckets

George Haiss Mfg. Co.—8-page illustrated bulletin H-850 gives specifications and application data on wide range of excavating and trenching, rehandling and light digging, general-purpose rehandling and special-purpose clamshell buckets. Various other materials handling products such as conveyors, highway loaders and crushing plants are described briefly.

58. Finishing Equipment

Newcomb-Detroit Co.—4-page illustrated bulletin 1j/N presents various types of systems for paint finishing, dust collecting, air handling and materials handling. Numerous applications and installations are shown in typical industries.

59. Core Blowers & Accessories

Western Hardware & Specialty Mfg. Co.—6-page illustrated folder "Wesco Core Blowers" covers both hopper and cartridge types. This pneumatically-operated machine has 3-in. stroke. Also described are sand cartridges and sand storage bins.

60. Lifting Magnets

Dings Magnetic Separator Co.—6-page illustrated catalog B-1401-A gives features, size ranges, lifting capacities, dimensions and ratings of new line of welded lifting magnets. Types of controls for use with magnets are explained.

61. Graphite Dispersions

Acheson Colloids Corp.—6-page illustrated bulletin No. 425 relates advantages of 'dag' colloidal graphite coatings in separating castings from molds in which they are made without damage to either casting or mold.

ADDITIONAL INFORMATION?

For additional information on any of the items described under "New Equipment and Supplies", "Trade Publications" or "Helpful Literature" in this issue — simply circle their corresponding item numbers on one of these cards.

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62. Dust Filters

Ruemelin Mfg. Co.—12-page illustrated bulletin 24-D depicts and describes tubular type dust filters designed for collecting dusts that are a nuisance or have salvage value. Utilizing cloth type filter, these units can reclaim dust particles down to 4-micron size and recover over 99.8 per cent of all dust loads.

63. Industrial Conveyors

Industrial Engineering & Mfg. Co. —2-page illustrated catalog sheet "Industrial Conveyors" is descriptive of portable unit for conveying stampings, scrap, process materials and cartons. Channel widths from 8 to 24 in. are available to convey to heights from 68 to 204 in.

64. Grinders & Buffers

Brown-Brockmeyer Co.—2-page illustrated bulletins 1010, 1020 and 1030 cover bench grinders, pedestal grinders and buffers, and grinder-buffers, respectively. Standard and special types of each class are shown and features, capacities and applications are discussed.

65. Portable Belt Conveyor

Barber-Greene Co.—8-page illustrated bulletin 374 lists fields of use and products handled by model 374 heavy-duty portable conveyor. Construction features, operating advantages and such accessories as feeders, screens and hoppers are depicted.

66. Fork Lift Trucks

Mobilift Corp.—6-page illustrated bulletin M-410 is descriptive of model E 'Stand-Up' and model ER 'Sit-Down' 2000-lb capacity Lev-R-Matic drive fork lift trucks.

67. Safety Equipment

Joseph Buegeleisen Co.—12-page illustrated catalog No. 1050 lists various types of industrial safety equipment including face protectors, hand pads, reversible mitts, protective aprons, sleeve guards and safety helmets.

68. Face Shields

Fendall Co.—2-page illustrated data sheet gives sizes and style numbers of face shields which afford worker protection against hazards of such operations as spot, flash and butt welding; sawing; grinding and polishing; descaling and light blast cleaning. Shields are light in weight, readily adjustable and comfortable to wear.

69. Material Handling Units

Palmer-Shile Co.—36-page illustrated catalog 50 describes complete line of materials handling equipment which includes standard and special skids and platforms, boxes and stands, racks, pallets, hand dump trucks, portable elevators, slings and grabs, barrel lifters, hand and warehouse trucks, heavy duty trailers, portable shelf racks and storage bins.

70. Overhead Conveyor

Taylor & Gaskin, Inc.—12-page illustrated bulletin describes All-Track chainless overhead conveyor characterized by absence of sprockets, traction wheels and roller turns. Drive is made through caterpillar that is self-contained and which can be installed in any section of straight track.

71. Self-Locking Nuts

Elastic Stop Nut Corp. of America—6-page illustrated folder "All Industry Finds the Red Elastic Collar the Best" describes available types of vibrationproof self-locking nuts. Also presented are selection pointers, typical uses and methods of application.

72. Nonferrous Castings

R. Lavin & Sons, Inc.—16-page illustrated publication "The Lavingot" Volume 6, No. 3, is fiftieth anniversary issue devoted to recapitulation of this firm's contributions to nonferrous metals industry. Outlined are company's facilities for research, development and production; tabular information on nonferrous casting alloys; and helpful notes on foundry practice.

73. Hoists & Cranes

Northern Engineering Works—8-page illustrated booklet E-312 shows various types of Hi-Lift hoists and cranes. Close-up and subassembly views show details of design and construction. Tabulated dimensional data for different capacities and spans for hoist cranes and end trucks are included.

74. Snap Flasks

V-G Flask & Fitting Co.—4-page illustrated price list No. 51 deals with V-G cherry snap flasks which feature malleable iron fittings, new hook type latch, adjustable hinges and machined bearing surfaces. Details of round pin assembly are included.

75. Hand Trucks

Lewis Shepard Products Inc.—16-page illustrated bulletin No. 29 is descriptive of Floormaster line of standard and special model hand trucks designed to facilitate materials handling for various types of industrial plants.

76. Overhead Cranes

Chicago Tramrail Co.—8-page illustrated broadside "On the Right Track" presents installation photographs of typical plant operations utilizing overhead cranes and depicts and describes 12 different models in line. Units are available in capacities of 1 to 10 tons with one, two or three motors which are floor controlled.

77. Truck Power Unit

Ready-Power Co.—2-page illustrated bulletin No. 118 announces new general-purpose model H-A gas electric power unit for industrial electric truck operation. Unit is powered by 22½-hp gasoline engine and output is 6 kw normal and 12 kw maximum.

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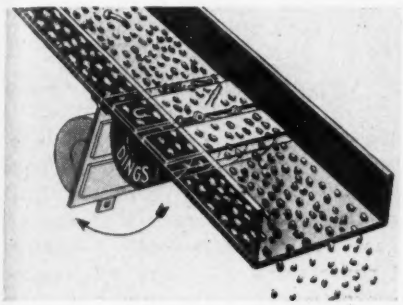
(*Continued from page* 210)

material. Filtering area is said to be large enough to assure full air flow after long periods of use. Trapped moisture is removed through a drain cock. Filter is available in ¼, ⅜, and ½-in. pipe sizes. Pipe connections are the straight in-line type.

For More Details Circle No. 19—Page 211

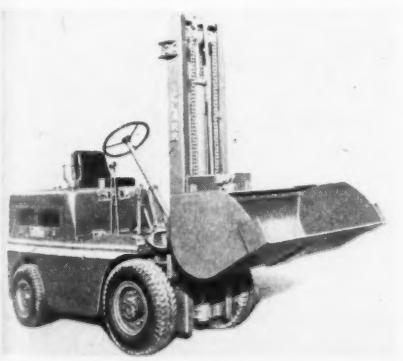
Permanent Magnets: Dings Magnetic Separator Co., 4740 West Electric Ave., Milwaukee 46 — Per-



manent plate magnets are offered in three magnetic field ranges. They are designed for removing miscellaneous tramp iron from wet or dry materials. Each type is made in 19 standard sizes from 4 in. wide through 72 in. wide and in 2, 4, 6, and 8 pole styles. The variation of the field strength between the three types is employed to allow selection of the magnet best suited to the job. All types are available in self-cleaning models.

For More Details Circle No. 20—Page 211

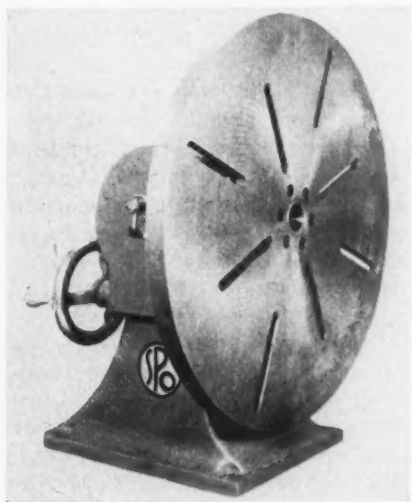
Shovel Attachment: Clark Equipment Co., Industrial Truck Division, Battle Creek, Mich.—Scoop shovel attachment for fork-lift trucks is designed for full hydraulic operation through the cycle of picking up a load, tilting back for carrying, dumping and return to scooping position. It will handle small castings, scrap steel, sand, and other aggre-



gate material. Shovel is interchangeable with standard forks and other attachments on the company's fork-lift trucks of 2000 to 7000-lb capacities. Self-sealing hose couplers are standard equipment. Shovel may be tilted from a carrying position 30 degrees above horizontal to a dumping position 45 degrees below with uprights vertical. Other features claimed are that a full load of material may be carried with safety in the new shovel when it is tilted back, and the load may be dumped from any height without shock to the upright assembly. Shovel is offered in widths of 38 to 72 in.; capacities range from 8 to 15 cu ft.

For More Details Circle No. 21—Page 211

Layout Table: SPO Inc., 6448 Grand Division Ave., Cleveland 5—Layout protractor table is designed for use with patterns, coreboxes, castings, etc., to facilitate checking or layout without disturbing the original setup. Incorporating a 30-in.-diam rotary table, the unit utilizes an indicator and vernier on an adjustable arm to permit direct readings, accurate to within 10 minutes. In addition, the circumference of the work table is graduated from 0 to



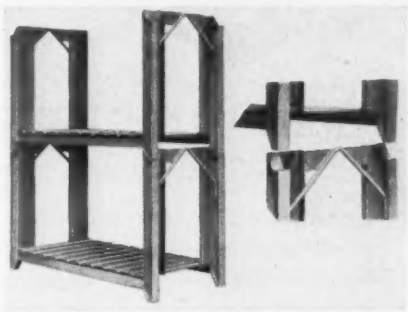
360 degrees in ½-degree markings. Table can be set and locked in any position within a 90-degree arc. Positioning is accomplished by a hand wheel actuated worm gear. Quadrant, which locks the table in position, is graduated from 0 to 90 degrees in 1-degree markings to facilitate layout accuracy.

For More Details Circle No. 22—Page 211

Metal Hardness Tester: Newage International Inc., 521 Fifth Ave., New York — Portable, direct reading metal hardness tester can be used on curved as well as flat surfaces, provided the radius of curve is not less than 3/32-in. Testers are available with dials graduated in Rockwell, brinell, diamond pyramid, or tons tensile. Performance of the instrument is said not to be affected by temperature variation. Standard instrument has a high range of 25-65 Rockwell C; medium range, 35-75 Rockwell A or 100-440 brinell; low range of 50-260 brinell.

For More Details Circle No. 23—Page 211

Stacking Racks: Palmer-Shile Co., 16033 Fullerton, Detroit 27—All steel, welded stacking racks with safety interlocking features may be handled by lift truck or crane. Racks have corrugated bottoms and I-beam ends. Interlocking ends are designed



to keep tiered racks securely in place. They are built on specification to meet user requirements. Color of paint also may be specified.

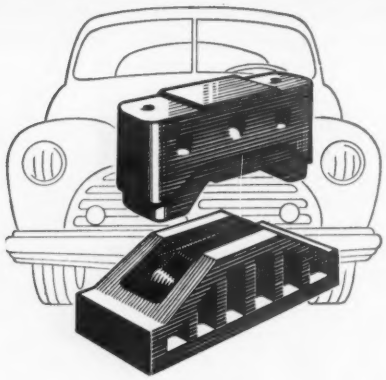
For More Details Circle No. 24—Page 211

Dust Collector: Hammond Machinery Builders Inc., 1605 Douglas Ave., Kalamazoo, Mich. — Cyclone type dust collector is offerd in two models—one for exhausting air to the outside, and the other, fitted with a dust-proof bag, permits recirculating the air. Capacity of both models is 1150 cfm at a velocity of 5600 fpm with 2 hp motor. Base is 26 in. diam and dust pan capacity is 10,620 cu in. Overall height is 86 in., inlet size is 6 in. and outlet size is 7 in.

For More Details Circle No. 25—Page 211

Utility Mixer: Claud S. Gordon Co., 3000 South Wallace St., Chicago 16—Utility mixer is designed

for making molding and core sand test mixtures or for preparing other laboratory samples. Mixer is hand operated and has a stainless steel mixing bowl 12 in. in diam and 5½-in. high. The mixing unit consists of a revolving arm with a scraper at one end for removing the mate-



cast-to-form dies

Easy machinability compared with steel, capacity to take a high polish in work, toughness to resist pressing stresses, and above all ability to resist abrasion—these qualities denote a good forming die.

The use of Molybdenum in cast iron dies has now become standard practice, because it most economically attains these desirable properties.

One of the suitable compositions is: 3.40% Total Carbon, 1.40% Silicon, 0.80% Manganese, with 0.25% Chromium, 0.10% Vanadium and 0.50% Molybdenum added.

This composition is one of many listings under "Dies" in our "Applications of Molybdenum Cast Irons"—an alphabetically arranged ready-reference booklet for busy foundrymen and for engineers—write for it!

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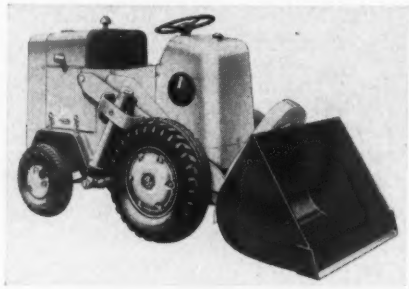
MOLY

F-1

rial from the wall of the bowl. At the other end of the pinion is a mixing paddle that rotates on its own axis as it travels around the bowl. The complete mixing unit is removable from bowl for cleaning.

For More Details Circle No. 26—Page 211

Tractor-Shovel: Frank G. Hough Co., 703 Sunnyside Ave., Libertyville, Ill.—Company's 12-cu-ft capacity tractor-shovel is said to have



been improved over previous models in these ways: Higher compression engine gives more power and economy; the clutch is larger; operator's compartment is roomier and more comfortable; steering gear and linkage is more rugged; main frame is stronger; a constant mesh transmission insures faster, quieter operation; maintenance operations are simplified by greater accessibility of engine and other parts.

For More Details Circle No. 27—Page 211

Lubricating Gun: Lincoln Engineering Co., 5702 Natural Bridge Ave., St. Louis 20—Portable electric lubricating gun has pressure primer for dispensing medium and heavy grade lubricants. Units are equipped with a manually operated screw feed pressure primer, spring loaded to

maintain positive and continuous primer even at low temperatures. Gun is designed for high-pressure lubrication in plants where compressed air is not available, or where electrically operated equipment is desired.

For More Details Circle No. 28—Page 211

Face Shields: Fendall Co., 4731 North Western Ave., Chicago 25 — Face shields are available with two different types of headgear: One is equipped with overhead brow guard or spark deflector; the other has open top for ventilation on hot jobs. Adjustable headbands are formed to fit the contour of the head for best comfort. Interchangeable windows snap onto headgear and are available in clear, green, or wire screen, in sizes and thicknesses to meet many requirements.

For More Details Circle No. 29—Page 211

Respirator Hood: American Optical Co., Southbridge, Mass. — Flyweight respirator hood is designed for protection against dust and paint spray operations. The respirator protects against a variety of dusts or gases by seven specific cartridges. Manufactured of white nylon, olive green twill or white muslin, the hood provides protection for eyes, head,

neck, shoulders, and respiratory organs. Two drawstrings tying under the wearers' arms assure snug fit. A 2¼ x 4-in. elastic strap sewn into the back of the hood is intended to provide a good fit for various head sizes.

For More Details Circle No. 30—Page 211

Aluminum Roofing: New Holland Metals Co., Mountville, Pa. —New type aluminum roofing, designed to give good strength and rigidity, is cross-crimped with small corrugations before forming. Other features claimed are that sun glare is broken by the new pattern of crimping, which also eliminates visible seams and overlapping. Its reflective ability is said to help keep buildings cool in summer. Roofing is available in 24 and 26 gage, 1¼ and 2½-in. corrugated, 5 V crimp. It does not rust and needs no painting.

For More Details Circle No. 31—Page 211

SAVED IN AS LITTLE AS 18 DAYS*

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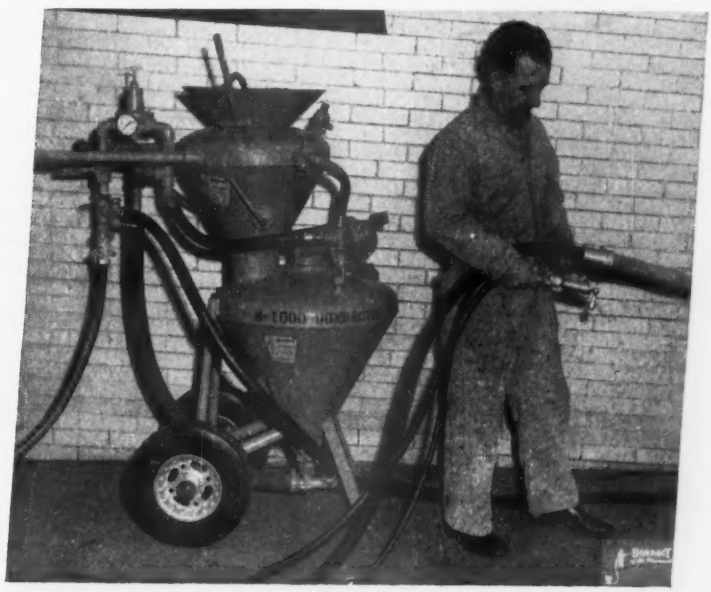
**Actual case for large foundry. Small foundries say 35-50 days.*

The Bondactor will save you money in cupola patching by reducing refractory loss and patching time. In one large foundry, this saving has been sufficient to pay for the equipment in less than one week. In smaller foundries, the savings range from $5,000 to $35,000 per year. The BONDACTOR equipment is now used in 156 foundries with outstanding success. Service records cover over 18 months of hard operation without a single reline of the cupola. Over the past forty years, attempts to "gun" patch have previously failed, but 156 satisfied foundries now prove that the BONDACTOR can and will do the job to your complete satisfaction — or your money back.



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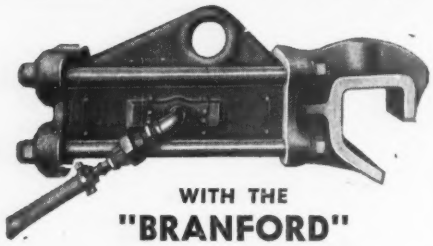

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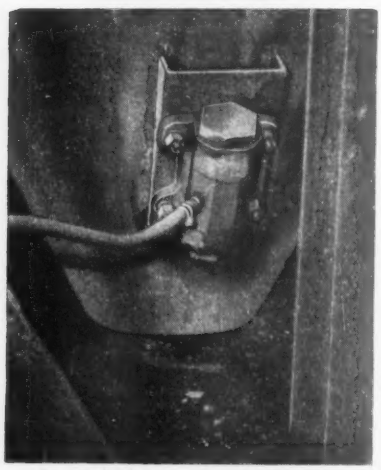

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NEW HAVEN Vibrator Company

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"White Coal" Pig Iron

(*Continued from page 93*)

tures.

The mixture melted was 300 lb Vantit pig and 700 lb cast iron scrap. No additions were made, and no alloys used, except in the pig iron, which added 0.18 per cent Va and 0.12 per cent Ti to the charge.

Test bars were poured, analyses made, and physical properties determined. In this case also the modulus of elasticity was determined by reading deflections and corresponding loads at small intervals up to the ultimate load. The modulus was figured at one-fourth of ultimate load, with corresponding deflection.

Physical properties and analysis of Series D were:

Transverse test—0.26-in. deflection of 18-in. span, 1.198-in. diam, under 2660-lb maximum load. Tensile strength 40,100 psi; brinell hardness (3000 kg) 241; modulus of rupture 70,570; modulus of elasticity 14,852,-195. Chemical analysis—TC 3.62 per cent, Mn 0.63 per cent, P 0.15 per cent, S 0.063 per cent, Si 1.78 per cent, Va 0.19 per cent, Ti 0.07 per cent.

In the Series D iron the graphite is Size 8, longest flakes 1/16-in. (Figs. 8 and 9). The graphite is Type D, interdendritic segregation, random orientation. This kind of graphite is formed, as in this instance, under special cooling conditions. It is desirable for certain kinds of castings where extremely short graphite is an advantage. It is noteworthy that the dendritic "islands" are completely pearlitic.

First thing to be noted in the analyses, is that all of the vanadium, and 58 per cent of the titanium was recovered in the castings. This probably accounted for the good strength (40,100 psi tensile) in spite of the fact no steel was used in the mixture, and that the carbon was rather high, 3.62 per cent. An estimate can be made of the effect of vanadium and titanium on this mixture by first figuring the carbon equivalent, then the tensile strength corresponding to that figure. Using the familiar equation, $CE = C + \frac{P + Si}{3}$, we find that carbon equivalent equals 4.26 per cent.

To get the corresponding tensile strength, we refer to the authoritative work of Barlow and Lorig: "Gray Cast Iron," *Transactions*, AFS, Vol. 54, page 546, 1946. In Fig. 3 we substitute the carbon equivalent of 4.26 per cent, and find the corresponding tensile strength to be 30,000 psi.

In other words, the tensile strength of 40,100 psi shown for this series in Table D is about 10,000 lb more than could be expected from its carbon equivalent. This may well be explained by the residual vanadium and titanium. Pages 68 and 69 in *Alloy Cast Irons Handbook* show the quantitative effects of vanadium and titanium on the strength of cast iron. The presence of 0.19 per cent vanadium should increase tensile strength by about 4000 lb, while 0.07 per cent titanium should add about 5000 lb more.

So, starting with a carbon equivalent base metal of 30,000 lb, we add 4000 lb for vanadium and 5000 lb for the titanium, and we have a total of 39,000 psi tensile strength, which checks rather closely with the strength actually found on these bars, or 40,-100 lb.

The effect of vanadium as a carbon stabilizer is probably shown in the microstructure of Fig. 12. The structure is entirely pearlitic, except for the fine graphite, and it is highly probable that there would have been a considerable amount of ferrite present, had there been no vanadium.

High Temperatures and Oxidation—The growth of cast iron after repeated heatings is due to the breaking up of the iron carbide, usually in pearlite, into ferrite and graphite. These products are more bulky, causing growth of the iron. If a strong carbide stabilizer is present, the iron carbide does not break up so readily under high temperatures, and the iron grows less, or not at all. For this reason vanadium is effective in preventing the deleterious effects of high temperatures. Another probable reason for the effect of vanadium is that the stable carbides and fine graphite offer less means of entrance for oxidizing gases, which in turn cause growth, due to the bulky nature of the oxides. It is stated in the *Alloy Cast Irons Handbook*, page 108, that: "as little as 0.10 per cent of vanadium lessens the increase of linear dimensions of cast iron by 20 per cent and decreases distortion by a similar amount."

"Scaling," or the formation of a coating of iron oxide, is a common way for gray iron castings to lose their usefulness when exposed to high temperatures in the presence of oxygen. This scale grows deeper rapidly on such parts as grate bars, stoker links, furnace parts, etc.

To get evidence on the effect of the vanadium-titanium combination on scale resistance, a bar from Series A and one from Series B were exposed for 24 hours to furnace atmosphere at 1650° F. Fig. 7 shows these bars, A on left, B on right. There is noticeably more scale on the B bar, which contained no Vantit pig,

than there is on the A bar, which contained 12½ per cent Vantit. Approximate thickness of scale: A bar 0.014 in.; B bar 0.022 in.

Corrosion — Very little has been written about the corrosion resistance of cast iron containing vanadium or titanium. Dr. Piwowarsky stated that amounts of titanium over 0.10 per cent increased the resistance of cast iron to acids.

Chromium increases the corrosion resistance of cast iron in sea water and in weak acids, and it is reasonable to suppose that vanadium, the other strong carbide former, would have the same effect. It is also highly probable that the finer graphite resulting from vanadium-titanium additions would offer less ingress to corrosive solutions.

To obtain more specific information, an immersion test was run. Slices of bars were cut from Series A (12½ per cent Vantit) and from Series B (no Vantit). Samples were cleaned of grease and immersed in separate jars of 10 per cent hydrochloric acid. At intervals of about three hours, samples were dried and weighed, and acid was replaced with fresh 10 per cent hydrochloric, at room temperature. Test was concluded after 15 hours. At that time sample A was still relatively smooth, while B sample had become appreciably rough. At this time final weighings were made, and showed these losses in weight: Series A 9.07 per cent, Series B 11.52 per cent.

It is extremely likely that vanadium-titanium combination gives cast iron additional resistance to corrosion in weak acids and salt solutions. Such resistance should be useful in castings subjected to mild corrosives, such as are encountered in pumps, liners, etc. For definite information, immersion tests should be run in solutions which might be encountered in service.

Wear—There is little specific laboratory test information on the effects of vanadium and titanium on resistance to wear. However, there is a strong sentiment in favor of the use of vanadium for increasing wear resistance. Quoting from *Alloy Cast Irons Handbook*, page 43: "The addition of vanadium to both gray irons and chilled irons very markedly increases the resistance to wear. This, no doubt, is related to its effect in stabilizing cementite, in maintaining the sorbitic state, or a condition of fine lamellar pearlite, and in influencing the mechanical properties generally through its effect on the dendritic structure."

More specific are the reports on the wear of diesel liners in ships. The indication was that the liners

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Nowhere, can you obtain a more uniform shot or a more durable quality for peening and blast cleaning. The pellet size and mass remain uniform many passes longer than with other types of shot. Outlasts conventional hard iron shot 8 to 1 and cast steel shot 2 to 1.

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FREE up your pattern, with a Cleveland Type SA air vibrator, to assure easy draw.

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containing Vantit pig iron outlasted good pearlitic iron liners by at least two to one (pamphlet, "Marine Diesel Engines and Piston Rings," A/S Bremanger Kraftselskab, Bergen, Norway.)

The present author in 1940 examined a large number of automotive cylinder blocks on which test mileage had been recorded, and decided that suitable microstructure was one of the most important things in combating wear. Quoting: "For the best cylinder bore structure—the author prefers a microstructure consisting of an entirely pearlitic matrix with long thin flakes of normal graphite, no ferrite, and sufficient small particles of iron-chrome carbide to increase resistance to wear." (E. K. Smith, "Cast Iron Cylinder Bores—Observations on Microstructure, Composition, Hardness, and Wear," *Transactions*, AFS, Vol. 48, 1940, page 667). It is interesting to note that the structures found in the vanadium-titanium irons meet this specification perfectly, except that in this case the minute carbides are of vanadium instead of chromium.

Fig. 6 shows a wear test still incomplete. In certain parts of heavy-duty pumps it is necessary to have highly polished cylinders which must resist wear to the greatest degree possible. The cylinder shown was machined from Series C vanadium-titanium cast iron. After 50 hours under pressure of 70 psi. at 3500rpm no measurable wear could be found.

Cleanness—Many alloys and other products are added to molten iron in the furnace or in the ladle, and it is usually stated that such additions act as "scavengers and deoxidizers." Such statements are often difficult

Second Industry-College Conference Is Planned

Program has been announced for the second Industry-College Conference to be held Jan. 20 at Case Institute of Technology, Cleveland. Conference is sponsored by CIT and the Relations with Industry Committee, American Society for Engineering Education. Industrialists, educators and representatives of the armed service will consider problems of mutual concern.

Speakers and subjects include: Dean Francis M. Dawson, College of Engineering, State University of Iowa, ASEE president, "Function of the Engineering College—Its Immediate Past and Possible Future;" G. M. Read, chief engineer, E. I. duPont de Nemours & Co., "Industry's Need for Engineers and Scientists;" Maj. Gen. Lewis B. Hershey, director of Selective Service, "Scientists and Engineers in the Military Establishment."

Three panels and subjects to be covered include: "Supply of and Need for Engineering Manpower," chairman—M. M. Boring, manager, technical personnel division, General Electric Co.; "Implementing Engineering Co-operation for National Defense," chairman—Edward N. Cole, plant manager, Cleveland Tank Plant, Cadillac Motor Car Division, GMC; "Effect of National Security on the Young Engineer," chairman—Dean C. J. Freund, College of Engineering, University of Detroit.

Executive committee which arranged the conference includes: Honorary chairman—Elmer Hutchisson, dean of faculty and acting president, CIT; chairman, George K. Dreher, executive secretary, Foundry Educational Foundation, Cleveland; William Culbertson, assistant to the president, CIT; Martin J. Bergen, E. I. du Pont deNemours & Co. and Douglass W. Miller, executive secretary, CIT.

DEAN FRANCIS M. DAWSON

MAJ. GEN. LEWIS B. HERSHEY

to prove or disprove, but in the present experiments, the evidence is clear. Fig. 5 shows the microstructure at 1000 diameters of the high-test iron, in which the Vantit pig had not been used. A large number of inclusions are present, although this iron would not be considered "dirty."

Comparing this with Figs. 3, 10, and 12 a remarkable difference will be noted. These photomicrographs, all at 1000 diameters, show the structures of metal in Series A, C, and D, in all of which Vantit pig was used. There is an unusual freedom from ordinary slag and oxide inclusions. (Fig. 10 has some crystals of manganese sulphide.)

The unusual cleanness of the latter mixtures is of course due to the presence of vanadium and titanium, both of which are strong deoxidizers, and are classed as "scavengers."

Costs—The subject of competing costs is outside the scope of this paper. Of necessity, an imported pig iron, manufactured by charcoal-electric process, with very low sulphur and phosphorus, and with 0.60 per cent vanadium and 0.40 per cent titanium, will cost more than standard domestic pig. The Vantit pig would, of course, be used only where its unique qualities would be valuable. However, the use of alloys is almost universal and a ton of Vantit pig iron contains about $50 worth of alloys. Where such alloys are of value and the low sulphur and phosphorus are advantages, the cost of this pig is not out of line.

Obviously such pig iron would be valuable in a good many steel applications, but as these experiments were limited to cast iron, steel uses will not be mentioned.

Alloys have a very definite place in the gray iron foundry but should be used only to attain certain properties in the castings. Such properties could be high strength, resistance to heat, resistance to corrosion, extra machinability, etc.

There is no universal alloy, good for everything.

To consider the vanadium-titanium combination: It can be used for resistance to heat, growth, oxidation, wear and possibly corrosion. It is valuable in obtaining pearlitic structures, where extra clean castings are required (micro-cleanness), and where low sulphur and phosphorus are needed.

Alloy Cast Irons Handbook, page 240 and following, lists various recommended alloy castings. Part of those specifying vanadium or titanium, or both, are: Clutch plates, cylinder heads, cylinder liners, compressor liners, pistons, piston rings, pressure castings, compressors, pumps,

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● This low-cost power wheelbarrow takes *all* the hard work out of hauling sand, coke, scrap, etc., because it has power both forward *and* reverse from 1½ to 4 m.p.h.

● Easily hauls 10 cu. ft. in big hopper, or carries 1200 lbs. on sturdy 4-ft. flatbed. Result: bigger loads per trip, less operator fatigue, more loads per day.

● *Standard-make*, 4 h.p., 4-cycle, gasoline engine takes full load up 20% ramps or grades. Handy 33" width clears narrow aisles and doorways . . . turns in own length.

● Moto-Bug has positive steering, direct to dual rear wheels. Large steering wheel with 3.6 to 1 gear ratio provides handling ease.

● Riding step, optional, plus positive steer arrangement, and forward and reverse power, let operator ride while traveling, spotting, and backing up.

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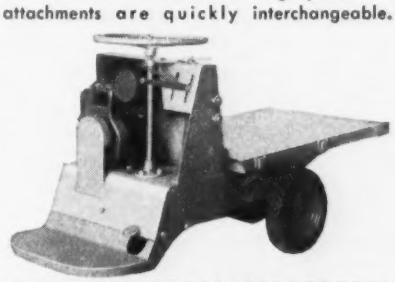

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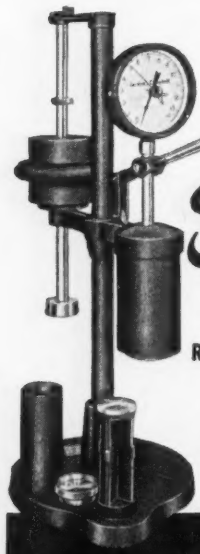

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Transverse Core Tester Rapidly determines transverse strength of sand cores.

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Each of these testing units was designed to conform with the recommendations of the Committee on Foundry Sand Research of the American Foundrymen's Society.

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dies of all kinds, gears of all kinds, glass molds.

To the above list we might add many others, such as: brake drums (with molybdenum), car wheels, and castings where high sulphur or phosphorus is giving difficulty, or where specifications for those elements are hard to meet.

Fig. 8 is of a die casting made with Vantit pig iron. Fine grain and excellent soundness were reported. In conclusion, it might be mentioned that customer reports on castings made with the vanadium-titanium pig iron have been uniformly favorable to date.

Pipe Molding Methods

(*Continued from page* 89)

A smaller barrel may be used by increasing the layers of rope. In an emergency a 5½ or even a 6-in. barrel may be employed by reducing the thickness of rope and loam to ½-in. each. However, this is a risky expedient and only to be attempted by a highly skilled coremaker provided with the best type of loam.

Either a length of heavy steel tube or a cast iron pipe may be employed as an arbor on which to build the core. One is just as serviceable as the other. Choice will depend on the relative cost. With patterns and corebox available on the premises—that is, patterns provided for some other purpose—a cast iron arbor can be made in the foundry at a comparatively low cost with the vent holes cored in. In a steel pipe the vent holes must be drilled. The cost to a certain extent will depend on whether new pipe or serviceable second hand pipe is used.

A second advantage of the steel pipe—and this is an important advantage where many cores are handled in a day—is that the barrels may be handled by hand in the coreroom. At a pinch the cores may be handled by hand after they are made.

Ends of the flask are cut to fit the core closely and thus prevent any crush in the sand coreprint at each end of the mold. If the flasks are made purposely for the job a projection may be either cast or bolted inside each end to rest on the coreprint. These projections will hold the core securely in place without any chaplets if a cast iron arbor is used. A steel pipe will bend a little and a chaplet must be placed over the center on the cope side if an absolutely uniform thickness is required in the casting. No chaplet is required on the bottom.

In making the core, the barrel is mounted in suitable bearings at each end so that it may be revolved freely. For small lots the barrel is turned by inserting a tapered wood plug attached to a crank handle in one end of the barrel. Friction holds the plug in place, and it easily is removed after it has served its purpose. In large installations the pipe is revolved by a simple belt driven device in which a clutch is thrown in or out by either a foot pedal or a hand lever.

The end of a hay or corrugated paper rope is anchored in one of the vent holes near one end of the barrel. While the barrel is turned a second operator keeps tension on the rope and pays it out until the barrel is covered. The second end of the rope is anchored to the barrel and the coremaker rubs a preliminary daubing of loam over the rope. He then sets the strike horizontally on two horses located at the proper distance from the barrel to outline the full size core. By manipulating the loam with the hands and slowly revolving the mass past the strike, the core readily is brought to the proper size and shape. The foregoing applies to the manufacture of pipe cores in small lots. In large installations the fixtures remain permanently in place.

MARCH OF DIMES

FIGHT INFANTILE PARALYSIS

JANUARY 15-31

After the core has been dried in the oven it is removed and placed again in the bearings. A coating of thin loam known as slurry is spread over the surface of the revolving core to form a perfectly smooth surface. Usually at this state the core is black washed, but whether or not it is black washed, it is returned to the oven for a final drying. Upon removal the second time it is hot enough to dry a coat of blacking.

In the ordinary jobbing shop, small lots of pipe cores are made from any one of a number of core sand mixtures. The half-cores are made in a half circular corebox, flopped out on a core plate and dried in the oven. The dried halves are matched, rubbed to a bearing and pasted. Outside the waste of core sand involved, the cores

made in this manner never are exactly true to shape. A green sand top will cut the cost to some extent. A half-core is dried in the usual manner and then placed joint side down on a green sand half core rammed in the same corebox. The halves are clamped together and rolled over, which brings the dried half underneath and the green half on top. The composite core is picked up and lowered into the mold. A suitable block or plug is incorporated in the center of the green half to support a chaplet. Another block, wood or iron, is mounted at each end of the dry sand half to anchor the core under the ends of the cope, or in other suitable manner with a bar clamped across the top of the cope.

Source of Trouble

A common source of trouble on pipe molded horizontally can be traced to the sand forming the ordinary core prints on the outside of the flanges. If the core is over size, or not truly round, the green sand will crush. If the print is unduly shaved to prevent this contingency, one of three things is bound to result. If the end of the flask is not stopped, the iron will run out. If the end is stopped, the iron will not run out, but a heavy and unsightly fin will have to be chipped from the end of the casting. In his zeal and anxiety to prevent a runout, the molder may tuck the sand too tightly and crush the sand into the flange. Two of these features will produce a scrap casting. The third involves a loss of time in the chipping room. All three automatically were eliminated in a typical instance which will bear somewhat extended reference.

In the belief that anticipated saving justified the expense a new pattern was made. The old pattern might have been changed but it had seen considerable service and was pock marked all over with the vent wire. For some time the foreman had been convinced no necessity existed for venting the mold with a wire, but when a habit becomes established in a shop, it is hard to persuade men that it is not necessary. He decided that the moral effect of a clean, new pattern might be a factor in keeping the vent wire out of the sand.

On the new pattern, the top and bottom brackets and the two brackets at the joint line were fastened permanently in place. The remaining two brackets above and below were held in place temporarily with wire nails. They readily were tucked in place and even if they did shift a trifle their usefulness was not affected. The principal change was the

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addition of 3 in. to the outside of the flange at each end. This was to serve as the new core print. A ring corebox was made containing prints for the bolt cores. This ring core also served for a core print to support the end of the long main core. Details of pattern, assembled core and ring corebox are shown in the accompanying illustrations.

Formerly the core was made in halves and dried. Afterward the two halves were pasted and wired together. The time on this item was reduced considerably by making the entire core in an iron corebox and drying it as a unit. A metal corebox is shown on page 88. Pattern for this metal corebox was made by nailing ½-in. strips, 1 in. wide, to five brackets equally spaced and designed to serve as supports for the long barrel. The pattern was molded concave side down. The sand was slicked and brushed with plumbago to insure a clean, smooth surface. Three boxes were made in this manner. In addition to providing cores for the long, flanged pipe, the coreboxes frequently were utilized for making other and shorter cores.

In making the core, sand was packed to a thickness of approximately 1½ in. around the inside of the corebox. A long piece of 5-in.-diameter steel pipe was bedded in place in the center. Additional sand was rammed around and over the steel pipe. After a sufficient quantity had been rammed in this manner, a sweep or strike with a semicircular 8-in. gap was worked from end to end to remove the surplus sand from the upper side. The strike was provided a shoulder at each lower extremity to guide it along the upper edge of the half corebox. The core was dried in the box. Sheets of paper laid in the box prevented the core from sticking.

The bolt core prints in the ring corebox were 3 in. in length. The bolt cores, 3½ in. long, were made in a gang corebox. Later the bolt cores were pasted into the ring and in that manner were held straight and true. A ring core was slipped onto each end of the long core before the latter was lowered into the mold. A *V* gap in the edge of the ring core engaged a corresponding projection in the bottom of the mold and brought the bolt cores into proper position, one bolt core between each pair of brackets. The long main core was held in place by the ring cores at each end and by two chaplets on the top. The flask was a few inches

Milwaukee Purchasing Agents Sponsor Exhibit

MILWAUKEE Association of Purchasing Agents sponsored a Products of Industry Exhibit at Milwaukee's Auditorium Oct. 17-19. Among the 150 exhibits were the following Wisconsin foundries and suppliers: Badger Brass & Aluminum Foundry Co., Walter Gerlinger Inc., General Malleable Corp., American Emery Wheel Works, Milwaukee Malleable & Gray Iron Works, Metallizing Co. of America, Milwaukee Chaplet Mfg. Co., Motor Castings Co., State Foundry & Machine Co., Universal Foundry Co., Wisconsin Centrifugal Foundry Co., Loeffelholz Co., K.H.P. Milwaukee Steel Co., and Wisconsin Chapter of the American Foundrymen's Society. Admission tickets were sent to firms, universities and colleges in Wisconsin. Photo by Badger Brass & Aluminum Foundry Co.

longer than the core. A piece of 3-in. pipe was shoved into each end of the core to provide a vent passage. The space between the end of the core and the end of the flask was rammed full of sand.

Statistical Quality Control

(*Continued from page* 95)

and plotted on a continuing graphic sheet covering a year. For Grade "C" steel ultimate strength and reduction of area are also analyzed monthly but not recorded on the permanent record.

Each plant is visited periodically by a representative of the research department who examines the chemical control charts, both as to form and results and reports to the manager of that department. The results of all these investigations by general office personnel are immediately reported to the plant management.

In addition to the statistical quality control just described, which is carried on in the interest of general quality supervision, the plants maintain other quality control records suited to the individual local needs. These differ greatly in different plants and are in a constant state of development. Many plants maintain the usual "X-R" charts for various sand properties to insure the quality of their molding materials. Some maintain chemical charts for special purposes or charts as to the performances of melting furnaces.

The company manufactures a large volume of railway specialties where dimensional tolerances must be adhered to. For such parts the customary "X-R" charts are maintained to give warning of approaching difficulties with dimensional tolerances requiring reworking. Such data are based on fractional inspection and we have not yet gone into the field of scientific selection of sample size. This is in part due to the fact that manufacturing tolerances can be kept at limits so far below the engineering tolerances set up for proper functioning that there has been no anxiety with regard to the adequacy of sampling. In one case—the pull required to raise a journal box lid —"X-R" charts based on representative sampling are maintained of actual test results, as well as of the dimensions and (purchased) spring characteristics required to produce these results.

In some cases we are concerned with "P" or attribute charts rather than with the "X-R" value and range charts. The former is used for per-

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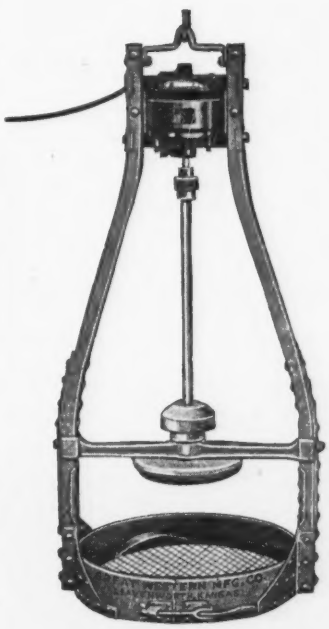

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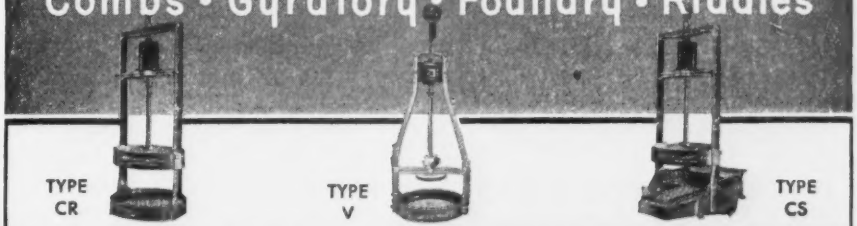

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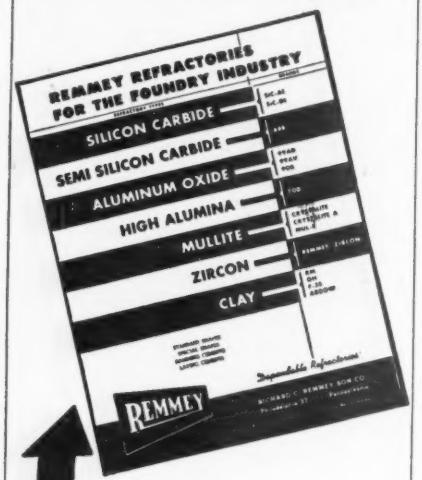

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centage defective where the observation is one of "yes" or "no" rather than "how much."

It is possible to construct tolerance limits for "P" charts but in the present state of development we have not adopted this refinement. Our "P" charts are mainly chronological records of defective castings, noncupped fractures and the like, calculated to keep the operators and superiors apprised of changes in results. The desired result, impossible of attainment, is in these cases zero.

Any discussion of statistical quality control in a relatively large organization must, of course, be somewhat sketchy and superficial. Our methods are admittedly compromises between the best possible treatment and that requiring a minimum of labor. No doubt we have not achieved the best results but can only hope that with increased experience we will improve our inadequacies and eliminate what is not useful.

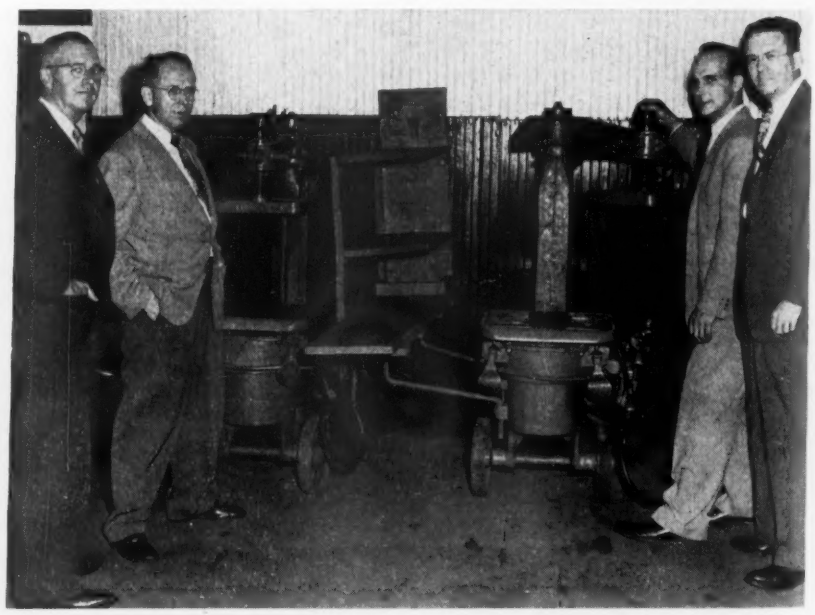
Malleable Industry Data

Malleable Founders' Society, Cleveland 14, has prepared a booklet, "Trade Marks and Trade Names in the Malleable Iron Castings Industry." Pocket-size, the booklet lists names of over 80 prominent American foundries and illustrates the trade marks that have come to be associated with each one. Also included are names and trade marks of outstanding Canadian foundries.

Plan Materials Handling Show and Conference

Fourth National Materials Handling Exposition, sponsored by the Material Handling Institute, will be held Apr. 30 to May 4, at the International Amphitheatre, Chicago. The exposition will add a huge outdoor arena to its exhibit space to permit demonstrations of yard handling equipment. Several hundred companies will exhibit thousands of models to provide extensive display of cost-reducing handling machinery.

During three of the five days of the exposition a Materials Handling Conference will be held, sponsored by the American Material Handling Society. Morning sessions will be devoted to consideration of general problems, including materials handling systems, relating handling to other departments, determining handling costs, and a program for top management. Afternoon sessions will consider special problems of separate industries. Advance registration cards and information may be obtained from Clapp & Poliak Inc., 341 Madison Ave., New York 17, who will conduct the exposition.



PURDUE GETS EQUIPMENT: Two molding machines recently were donated to Purdue University by Swayne Robinson & Co., Richmond, Ind. Shown above at the official acceptance of the equipment are, left to right: Charles Robinson, president, Swayne Robinson & Co.; Prof. R. W. Lindley, chairman of the shops at Purdue; Robert Spurgin III, development engineer and methods, Swayne Robinson & Co., and Prof. H. A. Bolz, department head, general engineering, Purdue

Metallic and Nonmetallic Coatings for Gray Iron

(*Continued from page 99*)

desirable to select a gray iron for calorizing that is resistant to growth. Many of these growth-resistant irons contain small amounts of chromium, and may require an increase in the quantity of chloride in the calorizing mixture to overcome the tendency for chromium to slow-up aluminum diffusion.

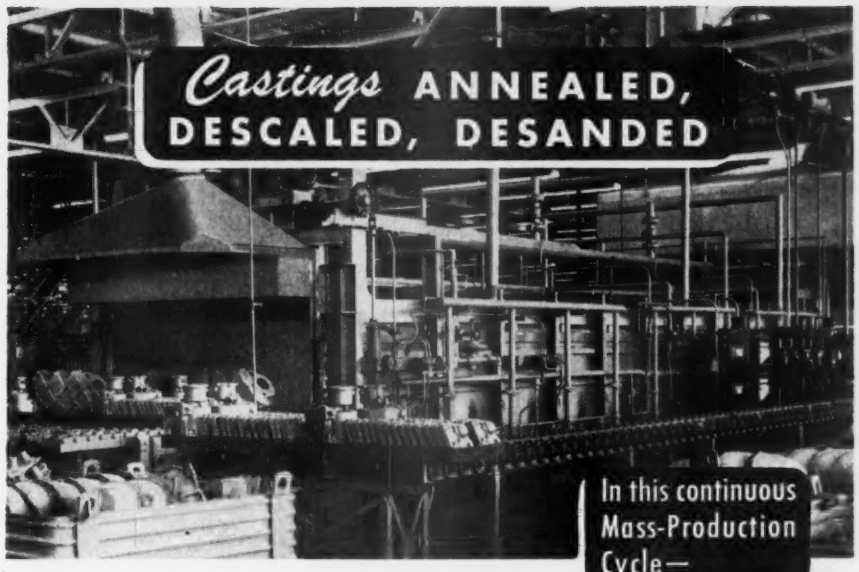
A similar process known as Aliting or Alitizing has been developed in Germany and involves replacing the aluminum powder in the calorizing process with a powdered iron-aluminum alloy containing around 60 per cent aluminum. Although some improvement in mechanical properties is claimed for the coating so obtained, it appears doubtful whether Alitizing is applicable to gray iron or other high carbon alloys due to the formation of Al_4C_3 which tends to be decomposed by damp air[39].

Pack in Retorts

The main disadvantage of either the calorizing or Alitizing process is the necessity that articles be packed in gas-tight retorts which limit the size of the castings and involve their treatment previous to assembling. To partly overcome these limitations two processes have been suggested. One, still largely in an experimental stage, involves deposition of a thin coating of aluminum by exposure to aluminum chloride vapor at temperatures of 1652-1832° F (900°-1000° C). The second process involves spraying an aluminum coating on the article[38] and then heat treating to promote alloying of the aluminum coating with the ferrous casting base. Protection must be given the sprayed coating during heating for alloying and is provided by materials such as bitumastic paint.

Calorizing and the other methods of producing aluminum-rich coatings may be used to protect containers used in treating metals, such as carburizing boxes, annealing boxes and trays, pots for lead, cyanide and salt, retorts, etc. and to protect furnace fittings such as doors, ash chutes, baffle plates, etc. and in miscellaneous applications such as heat exchangers. Protection both to high temperatures (up to 1400° F) and substantial resistance to sulphurous gases is claimed.

Chromium (Chromizing)—There is an increasing interest in chromizing, i.e., production of a high-chromium layer on gray iron or steel by displacement of iron by chromium and



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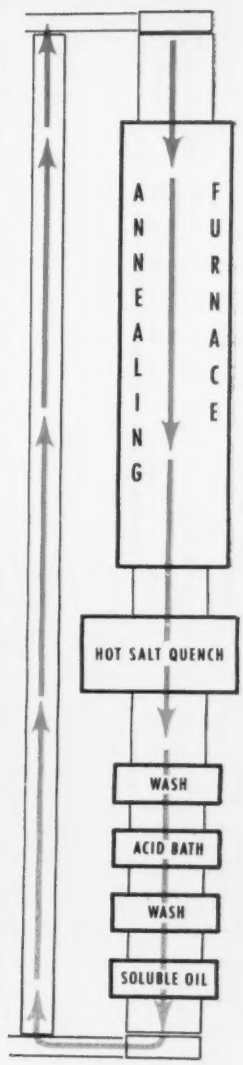

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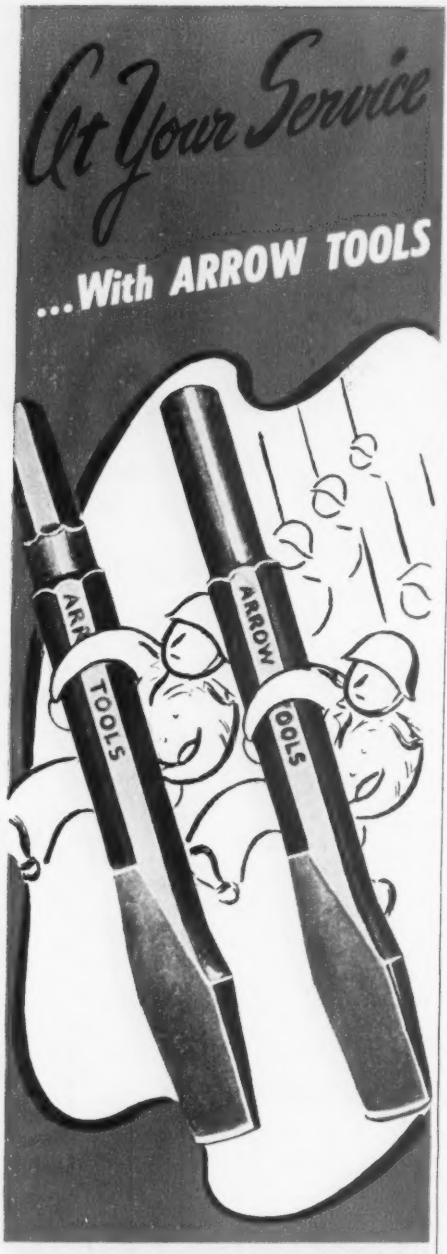

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diffusion of chromium into the base metal. Extensive commercial progress, in fact, took place in Germany during the last war. This interest is understandable as essentially such coated castings are as satisfactory from a surface performance standpoint as solid "stainless steels."[40] The resultant integral, non-flaking cases have a chromium content normally varying from about 35 to 70 per cent at the immediate surface to about 13 per cent chromium at the interface of the case and the base metal. This means that the surface of a casting so treated will exhibit the corrosion resistance, wear resistance, and oxidation resistance of a chromium-iron alloy of similar composition. For example, chromized layers as thin as 0.005 mm have exhibited complete resistance to a 1:2 concentrated nitric acid, water solution at room temperature during tests lasting over several months.

Potential importance and possibilities of chromizing gray iron have been high-lighted by recent work[40] on this subject sponsored by the U. S. Air Materiel Command, which has demonstrated that gray iron can be successfully chromized. Uniform, corrosion-resistant cases produced on gray iron were found to be of similar depth to those produced on SAE 1015 and other common types of steels, completely upsetting previous opinions, based on early work, that a very low carbon content in the base metal was necessary.

Essentially the process involves immersion of the gray iron casting in a molten bath consisting of 30 per cent chromous chloride, 30 per cent barium chloride and 21 per cent sodium chloride plus some chromium metal. The bath is heated to around 1000° C (1832° F) and case depths of 0.010 mm in one hour and 0.025 mm in three hours are produced.

Other methods of chromizing, such as the pack process, Chromalloying[41], BDS process[42], etc., should be mentioned. The same authors[40] that investigated the fused chloride method just described demonstrated that gray iron can be satisfactorily chromized by the pack process, i.e., by heating in a ferrochromium-alumina mixture in the presence of a hydrogen-hydrogen chloride gas atmosphere mixture. They report, however, that a longer time is apparently required in this pack process than in the fused salt method for an equal case depth; and the fused salt method possesses the further advantages that the process can be operated continuously without the packing, furnace-heating, furnace-cooling and unloading cycles necessary with either the pack or BDS process.

The Chromalloy[41] process has only recently been reported, and no details have so far been obtainable. It would appear to be a variation of the pack process and is claimed to be applicable to gray iron.

The BDS process, which has had some commercial application in treating steel, consists in heating parts to be chromized under a reducing or inert atmosphere in retorts together with chromous chloride-impregnated

EUROPEAN VISITORS: Seventeen members of the aluminum industry from England, France, Belgium, Netherlands, western Germany, Austria, Greece, and Ireland, in the United States studying secondary aluminum operations, recently concluded a series of fact-finding meetings with representatives of Apex Smelting Co. in Chicago and Cleveland. Russell Stuart of the Economic Co-operation Administration acted as guide and representative of the government for the mission, which was under the auspices of the Organization for European Economic Co-operation. Jean Dumontet of France acted as team leader

porcelain. The BDS process has itself apparently not been applied to gray iron.

Although no extensive commercial application in this country of chromizing either gray iron or steel is believed to have taken place, the possibilities are considerable. This is particularly so since the same process and materials can be used interchangeably for coating both gray iron and steel. Chromized valves, manifolds and pre-heater tubes are typical applications in which the process has been found useful in Germany.

Zinc (Sherardizing) — This process, simply one of zinc impregnation, consists in bringing iron articles, such as castings, in contact with zinc powder (maintained at 84-92 per cent metallic zinc) in tightly sealed revolving drums heated to 660 to 700° F. The resulting sherardized or zinc-iron coating has an average iron content of 8 to 10 per cent. The thickness of the coating produced in three hours is stated to be about 0.0025"[43].

Although the zinc-iron coatings are less anodic to iron than pure zinc and gradually darken, they do stand up well if the iron content does not exceed the indicated percentages. In fact, a report of ASTM Committee A-5 (1936) states that sherardized, hot-dipped and plated zinc coatings of equal thickness show about the same life in similar environments.

The advantage of the sherardizing process is that a uniform coating of zinc or iron-zinc alloy is produced. Threaded parts show no tendency to fill up as in hot-dip galvanizing, and, if allowance is made for the coating, do not need to be recut after sherardizing.

It is possible, as in many other cementation processes, to use hot dipping as a preliminary step. Thus the initial coating of zinc may be obtained by hot-dip galvanizing, and the galvanized article subsequently heated to produce diffusion of zinc inward from the surface and convert the coating to the desired iron-zinc alloy.

Electroplated Coatings — Electroplating is one of the most important methods of surface finishing metal objects. Outstanding surface properties, such as corrosion resistance, durability, hardness, etc., can be conferred on the base material by even very thin electrodeposited coatings. These practical advantages are usually coupled with improved appearance. Typical metals used for coating include copper, nickel, chromium, cadmium, zinc, tin, lead and alloys of these materials.

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Fig. 1—A Lanly Shelf Type Core Oven is heated by burners directly under the work chamber. Available in several standard sizes.

Fig. 2—A Two Compartment Car Type Mold Drying Oven. Each Compartment individually heated and controlled.

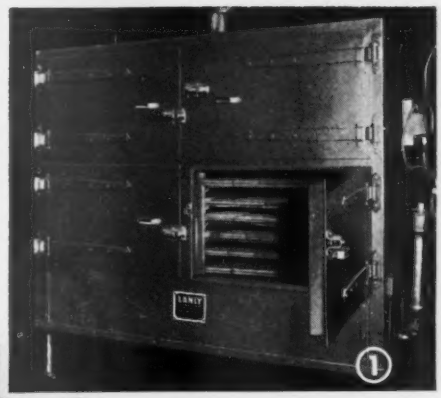

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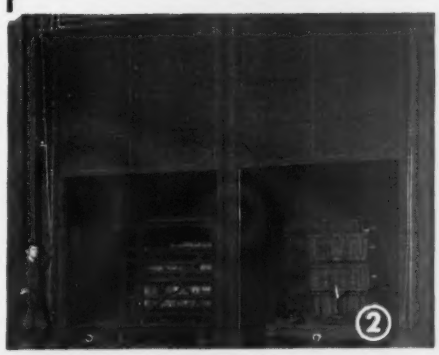
Fig. 3 — A Rack Type Oven which accommodates two racks side by side with a single set of doors.

Fig. 4 — Three Compartment Rack Type Oven with quick change-over combination gas burner equipment.



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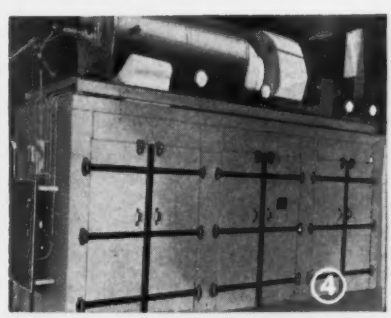

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plated castings has been delayed because the best preparatory cleaning methods and even optimum plating conditions for electrodepositing a number of metals on gray iron may differ from those for steel. Gray iron can be and is being satisfactorily electroplated with most commercial metals, but failure of some electroplaters to make proper allowance for these differences can lead to difficulties.

Since gray iron can be over-pickled, which may lead to the formation of a graphite smudge or to a low overvoltage condition conducive to hydrogen deposition, the best process is to avoid extended pickling if this is at all possible. Ground or machined surfaces, for example, do not require extended pickling, and with a good grade of casting, sand-blasting or tumbling in a medium which cuts rather than smears, is often sufficient to prepare the surface for plating. Alkaline cleaning may, of course, be used if necessary, and many platers regularly employ a final acid dip (for example of 3 to 10 seconds in 20 per cent hydrochloric acid solution) without any deleterious effects.[44, 45, 46]

Remove Sand and Scale

If it is necessary to remove scale, rust or traces of sand from the casting, two typical solutions have been recommended[45]: Solution 1—Sulphuric acid 1 pt, hydrofluoric acid 1 pt, water 1 gal, temperature room or elevated. Solution 2—Sulphuric acid 12 oz, nitric acid 5 oz, zinc 1 oz, water 1 gal. No temperature specified.

The above cleaning directions generally apply in all gray iron electroplating. However, experienced operators over the years have developed special cleaning cycles, sometimes applicable to both gray iron and steel and sometimes to gray iron alone, that have yielded optimum results with a given electrolyte or electrodeposited metal.

Nickel—Nickel plating is one of the most popular and useful methods of finishing gray iron for a large variety of industrial purposes. The many types of nickel plate fall into two general classes—the heavy, wear and corrosion-resistant "hard" plates, and various thinner decorative plates with more limited corrosion resistance.

Hard or heavy nickel plating has become progressively more important in recent years. Originally used for building up worn or mis-machined parts, its toughness, wear resistance, and corrosion resistance have recently led to its use in food processing equipment, in railroad equipment,

rolls used in paper and textile mills, filter plates, valves, beer pumps, etc. The deposits can be machined or ground, and once in service have a tendency to work-harden while their toughness minimizes danger of plate lifting, cracking or blistering.

In comparison with hard-chromium plating (the other heavy industrial plating process), hard nickel deposits, while they are less hard and wear resistant, are often more practicable both because of the higher throwing power of the nickel plating solution and because of the greater rate of nickel deposition, which renders this process preferable economically. When great hardness and wear resistance are required, a thin layer of chromium (approx. 0.003-in.) can be deposited after a build-up with nickel.

Outside of the usual cleaning precautions desirable in the case of gray iron, nickel plating of castings does not present any unusual problems, and the same cleaning techniques[47] are often used as for low carbon steel. In fact, unusually good agreement exists between widely separated authorities[47, 48, 49] as to the optimum cleaning cycle.

Nickel for Appearance

Decorative nickel plate, as opposed to the more utilitarian heavy nickel plate, has been used for many years in applications where attractive appearance is the main consideration. Nickel is especially suited for decorative plate because it does not oxidize appreciably in air and because it can be polished to a bright finish. In itself, thin nickel plate offers no galvanic protection to iron, and in layers of less than 0.005-in., corrosion of the base metal underneath the plate is possible. For this reason some operators first apply a layer of copper (usually 0.0005 to 0.0010-in.) to the base metal followed by an equal layer of nickel. For maximum adhesion of the deposit, an undercoat of copper is always advisable. Decorative nickel has been widely applied to sanitary ware, stove parts and many miscellaneous castings.

Three types of decorative nickel plate can be used on gray iron, depending on the type of bath used in plating. Of these three the oldest now in common use, and the basic nickel solution, is the Watts bath. This produces a dull, gray deposit which may, however, be buffed to a bright finish; it can be applied directly to gray iron and operates at a comparatively high speed. This bath is used especially in cases in which the brittle qualities of bright nickel plate are undesirable or with

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castings of large size which cannot be economically polished to the degree required for bright nickel plate.

By far more important in modern industry are the many processes for bright nickel plating. These produce a very lustrous, hard, corrosion-resistant coating which is highly decorative. Furthermore, this coating will impart its brightness to a subsequent thin layer of chromium. For this high finish, however, it is absolutely necessary that the base metal be carefully polished and free from defects of any kind. A certain amount of smoothness is usually gained by applying, and then highly buffing an initial layer of copper. The most important bright nickel baths are proprietary, but they consist essentially of a modified Watts bath to which small amounts of cobalt or one or another of the many commercially produced organic "brighteners" have been added.

A newer and quite promising type of plate, also proprietary, is the so-called semi-bright nickel plate. The advantages claimed for solutions of this type are that they have greater toughness and smoothing power than the normal bright nickel solutions, and that the semi-bright plate, since it can be easily buffed to a very bright finish, can be produced much more economically than dull nickel plate deposited from an unmodified Watts bath, which requires considerably more buffing.

Chromium—Chromium plating has assumed progressively more importance as a surface finish for gray iron. Thin decorative coatings, as well as heavier, hard, wear resistant coatings, are employed.

The familiar thin, decorative chromium plate represents the original method of chromium deposition. Because such a plate provides only incomplete corrosion resistance to the underlying metal, it is almost invariably applied over previously deposited layers of copper and nickel, or nickel alone. The resulting finish is comparatively hard, lustrous and highly attractive, and will not tarnish even under very severe conditions, being superior to even gold or platinum in some applications[50]. Chromium plated castings consequently find use wherever such surface properties are desirable; examples being bathroom or plumbing fixtures, household appliances, electrical equipment, etc. The functional value of such plating often goes beyond a simply decorative one, as, for example, in the case of chromium-plated sole plates of electric irons and chromium-plated skillets, both commonly made with gray iron as the basis metal.

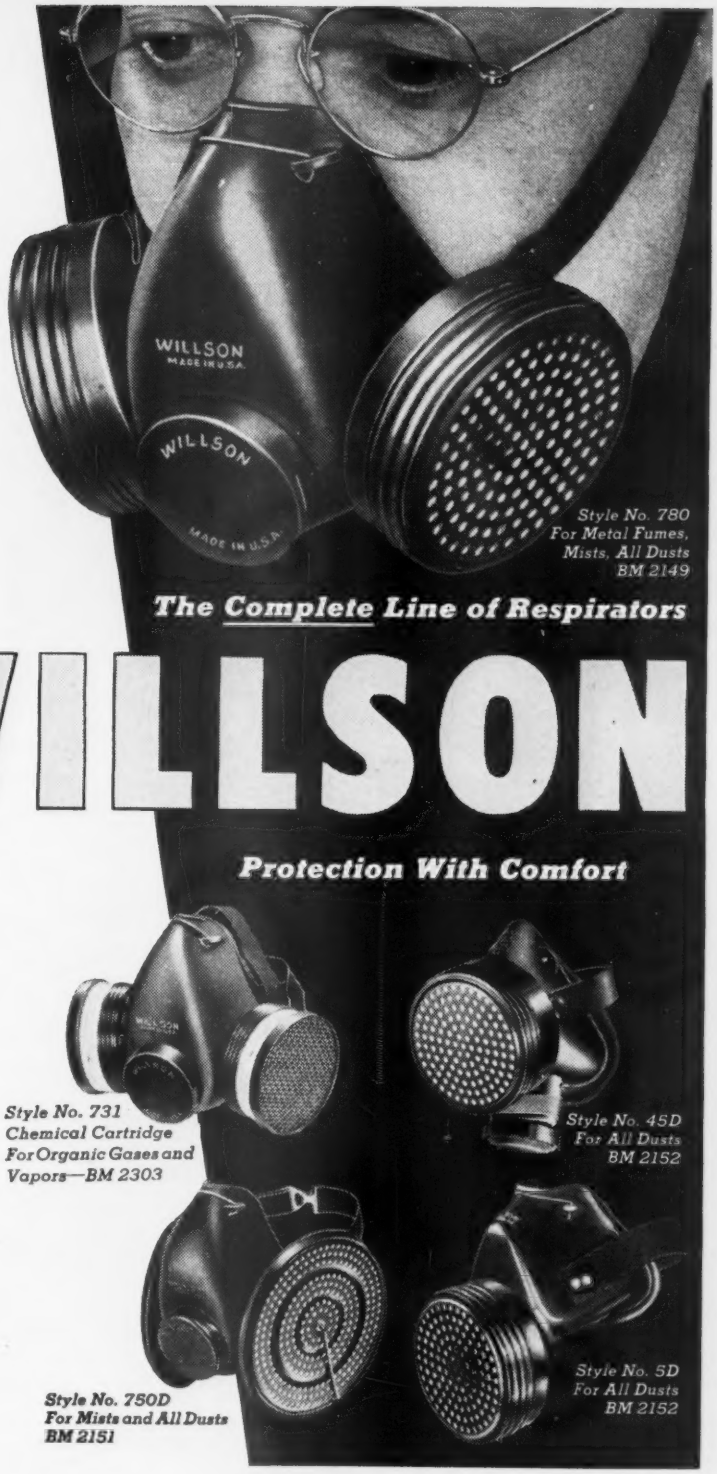
Production of heavier, so-called "hard" chromium deposits is a process which assumed great importance during the war. It is commonly applied directly to the gray iron base without intervening copper or nickel undercoats. "Hard" chromium plate is now recognized as one of the most useful of industrial finishes. Outside of the fact that it is usually directly plated on gray iron, it is in reality nothing but a thicker deposit of the normal decorative plate. It has, however, a number of excellent qualities which particularly suit it for use on gray iron.

It is extremely hard (brinell 1000-1025) with a low coefficient of friction, high seizure resistance and, in coatings of sufficient thickness, high resistance to corrosion and to the action of most common industrial reagents, except hydrochloric and sulphuric acids. Despite the comparatively high cost of the process, these remarkable characteristics have led to its wide use in such applications as rolls for the paper industry, dies for forming plastics, linings for cast iron bushings, glass manufacturing equipment, rams, plungers, spindles, automotive operating parts, etc.

Plating Is Porous

A process which has increased the usefulness of plated gray iron in automotive and diesel engines is "porous" chromium plating. It was found that the "hard" chromium plate, despite a low coefficient of friction was frequently unsuitable for the plating of cylinder bores because of its poor lubricating qualities and especially because of the difficulty of machining the bores to the desired tolerances. However, a plate was developed which was porous—that is, deliberately designed to contain pits or channels which would serve to hold the lubricant and avoid seizing or galling. Using this plate, the life of gray iron cylinder bores, has been measurably increased[51]. Its application is gradually spreading to other castings, such as compressors, hydraulic equipment and special rolls, where lubrication is critical or easy release of substances from the plated surface is demanded.

Three methods of applying porous chromium plate to gray iron are in use, i.e., producing in the final plate the desired series of indentations and prominences. They are the "mechanical" method—which involves hard chromium plating over a roughened cut, engraved, etched or grit blasted basis metal—and the "pit" and "channel" methods in which the porosity is induced by chemical or electrochemical etching of chromium



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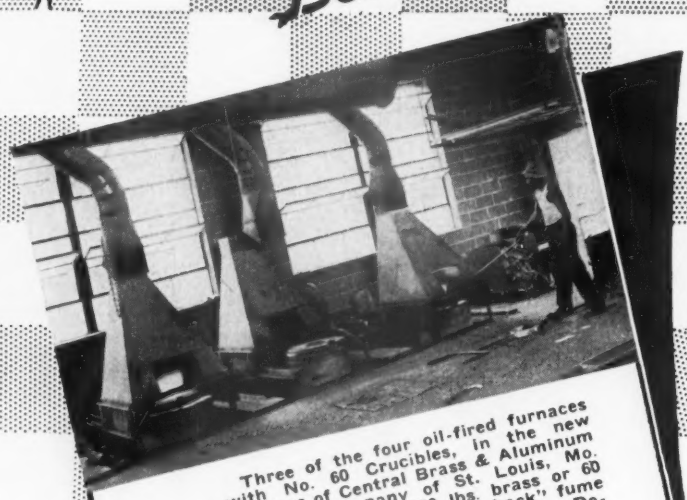

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deposits predisposed to etch unevenly[52]. If care is taken in removing the debris that can result on polishing or honing such a deposit, reductions in piston wear of as much as 75 per cent have been reported[53]. Extensive tests have proved the practicability of applying porous chromium plating to gray iron, and this process should materially extend the usefulness of gray iron castings under specially severe or exacting wear conditions.

Cadmium—Many of the advantages of zinc coatings, such as electrochemical protection against corrosion, can be found in cadmium coatings. In addition, cadmium can be very readily deposited on gray iron castings using either "still" or "barrel" methods. It is by far more common than zinc plating as concerns gray iron and offers better protection than zinc does to attack by alkalis or by a marine atmosphere. One other factor which often makes cadmium preferable is that, while under ordinary atmospheric conditions it corrodes somewhat more rapidly than zinc, it is preferable for use on castings which are threaded or operate with close tolerances, where the unsightly and bulky white corrosion products of zinc may often interfere with the action of a machine or make it difficult to remove parts for inspection or replacement.

Cadmium More Expensive

Unfortunately, however, cadmium is more expensive than zinc and has, therefore, been mainly used in: (1) indoor applications where only a thin coating is necessary; (2) on products for which zinc coatings are definitely unsuitable (such as in machine parts); or (3) as an undercoat to assure perfect adhesion and covering of gray iron castings with zinc. In view, however, of its attractive white, lustrous finish and particularly in view of the economy arising from the ease of surface preparation of the base metal, the ease of deposition and of finishing the cadmium deposit, it may well prove to be the most practicable coating in many instances where less expensive metals are now used.[54, 55 56, 57]

There are no particular difficulties in preparing gray iron for cadmium deposition; cadmium will give a satisfactory coat on either rough or machined surfaces, and sand or shot blasting usually provides a satisfactory surface[83], although an acid dip (3 to 10 seconds in 20 per cent hydrochloric acid) is frequently employed.

The value of the cadmium coat, and accordingly that of the cadmium-

coated casting, can be enhanced by further finishing of the deposit. The most common finishing procedure is "bright dipping". The "bright dips" are solutions of oxidizing agents which impart a lustrous surface to the deposit. Chromate passivation may also be helpful. Paint may be applied to the cadmium surface after bonderizing[54, 55].

Zinc—In rural atmospheres and in some other applications where corrosion resistance rather than wear resistance or attractive appearance is the main consideration, zinc plate may often be the most economical electrodeposited finish for gray iron. It is not, however, widely used because of past difficulties of plating zinc directly on gray iron from the cyanide bath, the most frequently used of zinc electrolytes, and cadmium plate is usually substituted.

Zinc Coating Economical

Gray iron, notwithstanding the usual prejudice based on indifferent success with a cyanide bath, can be successfully electrogalvanized in either an acid[58, 59, 60, 61] or fluoborate bath. If the casting is not of an intricate shape, zinc plating from the acid bath may be the most economical method of providing a protective coating, the main disadvantage of the acid as opposed to either fluoborate or cyanide baths being its low throwing power.

For rapidly deposited coatings with good adhesion, uniform coverage, and a more attractive finish, the recently developed fluoborate bath[62] may be used. Recent developments[63] indicate also, that some relief may be brought to the electroplater equipped only with the usual cyanide bath, and that he may now undertake zinc plating of gray iron with considerable confidence.

Although, as far as can be learned, there has been limited commercial application of zinc-plated castings, the process is entirely feasible. If the comparatively thin electrodeposited layer is adequate, zinc-plated castings can be used in the same type of applications and with the same confidence as hot-dipped galvanized castings.

Copper—Copper plating is widely used as an undercoat in nickel and chromium plating and to generally produce a base surface ideally suited for electrodeposition of other metals. For example, it is employed as a soft overlay on the base metal since it can be more readily buffed to a high polish previous to bright plating with more corrosion resistant metals. There has also been considerable development of "bright" copper plating to facilitate smooth deposits of nickel

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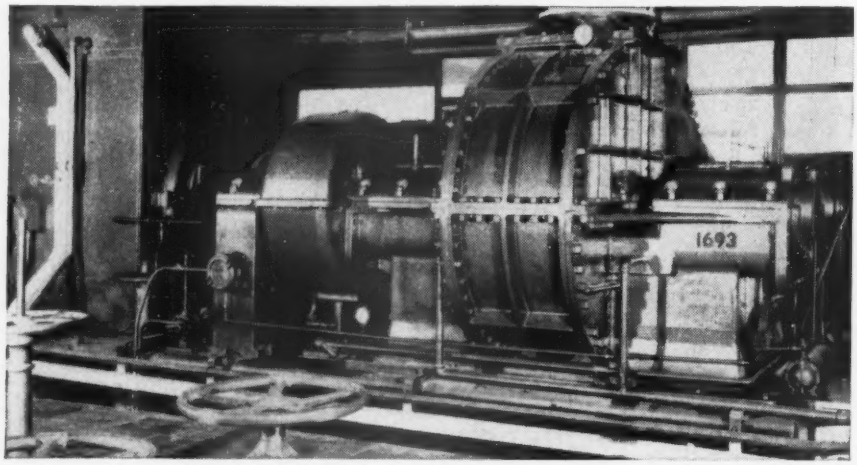

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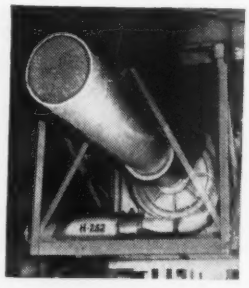

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and chromium in the same manner.

It is also considered by some operators that a copper strike or flash is an essential part of the cleaning or preparatory cycle for electroplating. In itself copper plating is very rarely used as a final covering plate because of its tendency to develop unsightly corrosion and oxidation products. However, some use of copper plating is made to simulate "statuary bronze" or other specially colored metallic finishes, in which case it is usually protected by a coat of lacquer.

Tin—Electrotinning of gray iron has not been actively pursued because of the wide use of the hot-tinning process. Nevertheless, in applications where either thin, very uniform coats or heavier coats than can be produced in hot-dipping are desired, or where an oddly shaped casting or one with deep recesses cannot be successfully hot-tinned, gray iron has been electrotinned. Such applications include dairy appliances, kitchen fittings, and a number of domestic accessories. Electrotinplate has also been used on bearing surfaces, and while not the best material, is, in cases where it is adequate, one of the cheapest and most readily available of bearing metals. As concerns bearing quality, electrotinning has been found to be of value to facilitate "break-in" of piston rings.

Other Metals—Lead plating as a protective coating for gray iron has not been extensively employed because it does not give as good atmospheric protection as the more readily available zinc and cadmium plates. A limited use has been found, however, in containers for dilute sulphuric acid and other corrosive liquids where a pure lead coating is desirable. A few other applications are known or have been suggested, as, for example, lead plating of bearing surfaces. Electrodeposited lead is less porous than a hot-dipped lead coating. A thin flash of copper is said to increase the value of thin lead coatings.

Many of the desirable qualities of metallic deposits can be improved by the deposition of two or more metals at the same time. The commonest types of alloy plate produced at present are brass, bronze, lead-tin, tin-zinc, and nickel-cobalt, although a few other metal combinations are electrodeposited to a limited degree.

Although brass and bronze plates have found wide use, there is very little information as regards any special techniques desirable in applying them to gray iron. The three main uses are: (1) to create a dec-

orative coating which makes the casting resemble solid brass or bronze; (2) to provide chemical characteristics typical of these alloys, and (3) to provide special surfaces, such as a surface suitable for bonding with rubber, in which case brass provides a better bond than does any other metal. A copper-cadmium bath has also been developed for bronze plating.

By co-deposition of lead and tin an alloy coating is formed which is more fine-grained than the deposit of either metal alone. This alloy, which is deposited from the fluoborate bath has found some application in coating parts for furnace brazing, parts requiring soldering, bearing surfaces and miscellaneous hardware[64].

A highly corrosion-resistant alloy containing typically 78 per cent tin and 22 per cent zinc has recently been developed and may prove a useful coating for gray iron[65, 66]. The co-deposition with nickel of a small amount of cobalt has been found to give a very bright finish[67]. Hard, wear and corrosion resistant nickel-phosphorus and cobalt-phosphorus alloys can also be deposited on gray iron[68].

The field of alloy plated castings presents many opportunities for profitable exploitation. As in the case of single electrodeposited metals, component parts possessing surfaces uniquely fitted to a particular service can often be produced at minimum cost by electroplating gray iron. Research going forward on deposition of other metals such as tungsten, magnesium and antimony[69], should further enlarge the field of application.

(To be concluded next month)

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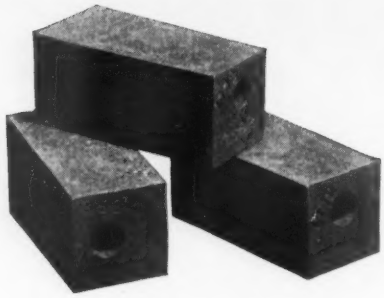

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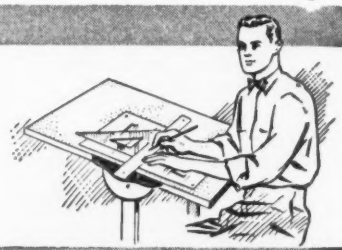

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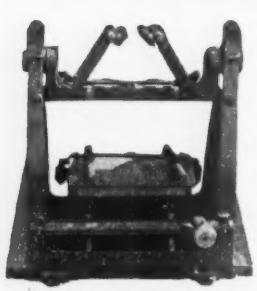

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Sources of Illustrations

Figs. 7, 8, 9—Stoody Corp., Whittier, Calif.
Fig. 10—Coast Metals Inc., Canton, O.
Fig. 11—Battelle Memorial Institute, Columbus, O.
Fig. 12—Plating Engineering Co., Milwaukee
Fig. 13—Toledo Scale Co., Toledo, O.
Fig. 15—Tin Research Institute, Middlesex, England
Fig. 16—General Electric Co., Schenectady, N. Y.
Fig. 17—W. & T. Avery Ltd., Birmingham, England

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Meehanite Producers Meet

About 120 representatives of licensees of the Meehanite Metal Corp. convened Nov. 9-10 at the Knickerbocker Hotel, Chicago, for the organization's 1950 research meeting. More than 30 papers featured the four sessions devoted to foundry practice, metallurgy, core-making, engineering, management and sales.

Effect of Oxygen Content on Casting Properties

(*Continued from page* 103)

deoxidized malleable iron melts by bubbling hydrogen through them and found that this enhanced nuclei formation so that the iron showed improved annealability. Similarly, Schwartz[9] determined that the addition of strong deoxidizers, such as aluminum, to molten malleable iron has a pronounced effect on the size and number of graphite particles formed during annealing.

The work of Heine[8] has recently confirmed the results of the previous investigators with reference to the influence of deoxidation on annealability of malleable iron. He demonstrated that aluminum, hydrogen and titanium can be used to deoxidize malleable iron melts so that they promote first stage graphitization and substantially reduce the required annealing time of the castings.

Deoxidizers Affect Malleable

Schwartz[9] and other investigators have determined that other strong deoxidizers, such as boron, affect malleable iron similar to aluminum and hydrogen, if added in very small and controlled quantities. Practically all of the investigations have disclosed that additions of the usual strong deoxidizers are effective only up to the relatively small amounts required to properly deoxidize the melt. Additions beyond this point simply introduce residual amounts of the deoxidizing element into solution in the iron and influence the properties of the iron in accordance with their chemical and alloying effects.

The knowledge that residual aluminum serves to induce porosity in iron castings, residual titanium and boron act as strong carbide stabilizers and harden the iron excessively, and hydrogen produces an embrittling effect, has served to limit the use of these deoxidizers in iron foundries because of the dangers thus introduced. Indeed, some deoxidizers, such as manganese, appear to have such strong carbide forming or stabilizing effects that from the outset it outweighs the graphitizing effect they produce by deoxidation. In this connection, Schwartz observed that most of the elements promoting graphitization are deoxidizers, with manganese constituting an exception in that it was found to decrease graphitization in malleable iron.

The foregoing discussion makes it apparent that, to be useful to foundrymen, the successful deoxidizer must

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meet all of four requirements.

1. It must be sufficiently active to react with dissolved oxygen or oxides and reduce their concentration in the iron to the required low value.
2. It must be capable of being brought into intimate contact with the iron for a sufficient length of time to enable such reaction to take place.
3. The deoxidation reaction must not produce harmful by-products.
4. Ordinary amounts of residual deoxidizer dissolved in the iron must be harmless.

The silicon and carbon in the iron fulfill the last three conditions but, unfortunately, not the first. Additions of ferrosilicon, graphite and many proprietary alloy deoxidizers are now being made to iron in the ladle. Such additions have achieved some measure of deoxidation as evidenced by their nucleating or "inoculating" effects.

Active Deoxidizers Available

The search for more active deoxidizers which are not harmful in iron led the Carborundum Co. to produce a specially-prepared metallurgical grade of silicon carbide to serve this purpose. This deoxidizer, known as Ferrocarbo, has been demonstrated to have a sufficiently high melting point (4500° F) that it can be added successfully to the cupola charge in briquetted form. The amount added usually is 1 per cent of the weight of metal charged (20 lb per ton).

The briquetted deoxidizer is charged on top of the coke splits and descends the stack of the cupola with each charge during melting, each briquet remaining intact until it reaches the melting zone. At this point, the silicon carbide comes in contact with molten iron and dissolves in it. In solution, the compound is unstable and ionizes into atoms of nascent silicon and carbon. In this nascent atomic state the silicon and carbon are unusually reactive and are capable of reducing the dissolved oxygen and oxides to the required low concentration necessary to avoid the production of oxidized iron.

Thus, by solution of this form of silicon carbide compound in iron, its constituent silicon and carbon atoms are rendered sufficiently more active than the usual molecular forms of these elements normally present in the iron and in ladle additions. Consequently, this deoxidizer is sufficiently active in the cupola to satisfy the first requisite previously mentioned.

The refractoriness of silicon carbide out of contact with molten iron, which enables it to be utilized within the

cupola, allows it to come in intimate and prolonged contact with the molten iron. This permits the deoxidation reactions to be completed, and the CO produced by the carbon reaction passes out with the cupola effluent gases while SiO_2 from the silicon reaction has adequate time to separate from the iron and pass off with the cupola slag. In this way, the second and third requirements of a satisfactory deoxidizer are successfully met. The final requirement is also obviously satisfied since the silicon and carbon of which the deoxidizer is composed are normal constituents of the iron.

Deoxidizing Efficiency — The most practical measure of degree of deoxidation achieved in the cupola is obtained by observation of the color and analysis of the cupola slag, since it is substantially in equilibrium with the metal produced. The reliability of this relationship has been indicated by the work of Vennerholm and Bogart,[11] which showed excellent correlation between the FeO content of the slags formed when melting white cast iron and the amount of castings requiring re-annealing. The greater the amount of FeO in the slags, the more material that had to be re-annealed

The reduction in iron oxide content of cupola slags obtained by use of silicon carbide in the cupola charges, is indicated in Table I. It should be noted that the FeO content of slags produced during the melting of iron not deoxidized in the cupola, varies over a fairly wide range. It is also apparent that the cupola deoxidation treatment is effective in reducing the iron oxide content, regardless of its original concentration. Sufficient tests were made and samples taken at three different foundries when compiling these figures, to insure that the differences revealed are representative.

Reduction in Segregation—One of the important effects produced in iron by this method of deoxidation is reduced segregation. Structural constituents particularly prone to segregate in oxidized iron are graphite, iron carbide and phosphorus. Segregates of these components in iron are detrimental because they form planes of weakness which adversely effect the physical properties and machinability of the castings.

The importance of eliminating segregation of graphite in gray iron has been widely recognized in recent years and has led to widespread use of ladle deoxidizers or inoculants to produce desirable randomly distributed graphite structures. The effectiveness of such additions is meas-

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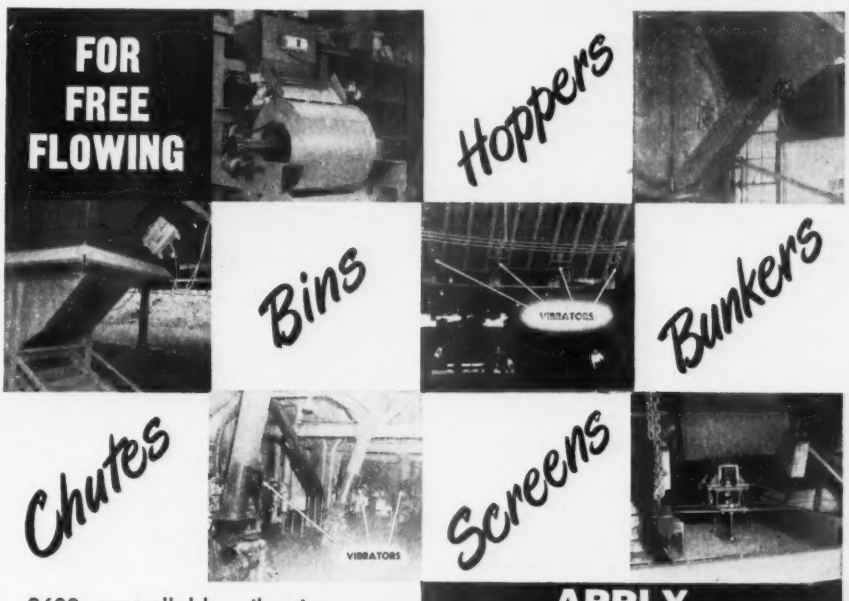

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ured by the deoxidizing efficiency and is related to the increase in graphite nodule count and faster annealing rates accomplished in malleable iron by use of deoxidizers.

The fact that deoxidation with metallurgical silicon carbide has reduced graphitic segregation has been established by numerous tests in many foundries and is illustrated in Fig. 2. The corresponding effect of such additions in the melting of cupola-air furnace duplex malleable iron on graphite nodule count is given in Fig. 1.

Similar dispersion and refinement of carbide structures in gray and malleable irons resulting from treatment with this deoxidizer is shown in Fig. 3. It will be noted that the deoxidation prevents retention of massive carbide segregates and also reduces the total amount of carbides retained in gray iron. Extensive tests have also demonstrated that dispersion of phosphide segregations is accomplished by the silicon carbide deoxidation process.

It might also be mentioned that iron oxide itself, if not removed from solution in the iron by deoxidation, will tend to segregate as the iron freezes. Being a low melting point constituent, it will segregate in the center structure which is the last to freeze. This segregation adversely affects the castings in the same way that phosphorus does. It is suggested that such segregations of the carbide stabilizing iron oxide are responsible for the phenomenon of "inverse chill' frequently observed in castings.

The effectiveness of cupola deoxidation in reducing chill in gray iron of standard composition cast in green sand and also dry sand molds, is illustrated in Fig. 5.

Machinability—The improvement in machinability of gray iron obtained by this deoxidation method has been demonstrated many times through tests conducted in foundries making a wide variety of castings in which machinability is an important cost factor. It is believed that this improved machinability is a natural result of the graphitization and dispersion of segregates produced by thorough deoxidation.

Various machining tests have demonstrated that if the hard constituents of the microstructure are small and dispersed, they interfere less with the tool during machining than when they occur in massive or continuous formations. Since the hard carbide and phosphide constituents range from 500 to 700 brinell, it is readily apparent that a reduction in their amount and degree of segregation will serve to substantially increase tool life and permit higher machining speeds.

One foundry, for instance, in producing a 950-lb power cylinder for a large gas engine from iron containing 3.10 per cent total carbon and 1.50 per cent silicon, was able to increase the machining speed of a turning operation from 50 surface fpm to 66, by deoxiding the iron with metallurgical silicon carbide. In another case, a manufacturer of soft iron castings for the automotive industry was able to increase tool life 35 to 40 per cent at constant machining speed. The iron contained approximately 3.40 per cent total carbon and 2.50 per cent silicon, the tool life data being obtained from a month's run of castings produced from cupola deoxidized iron as compared to the previous practice without such deoxidation.

Investigate Machinability

A carefully controlled investigation of machinability was conducted by Mellon Institute of Industrial Research in collaboration with Cincinnati Milling Machine Co. and Allis-Chalmers Mfg. Co. in which 40 machinability test rings were cast over a period of ten operating days. The rings were 9 in. OD by 7 in. ID and ½-in. thick. One half of these disks were cast from iron melted without deoxidation and the other half were deoxidized with silicon carbide briquets in the cupola. The desired composition in all the specimens was 3.35 per cent total carbon and 1.80 to 2.00 per cent silicon.

The comparative machinability of two sets of samples of the same average composition was determined at Cincinnati Milling Machine Co., using a tool life test devised by them which has been demonstrated to give reliable results that correlate well with production experience. The undeoxidized samples had an average carbon equivalent of 4.17 while that of the deoxidized samples was 4.15. The machinability tests were conducted at three speeds of approximately 150, 200 and 300 fpm. In each test, the number of cubic inches of metal removed in producing a uniform wear land of 0.005-in. on a carbide cutting tool, after successive 1/16-in. milling cuts, was measured. The results obtained by them on comparable deoxidized and undeoxidized sets of test specimens are presented graphically in Fig. 4.

It will be noted from the graphs that the superior machining properties of cupola deoxidized irons becomes increasingly apparent as the machining speed is increased. For instance, the improvement at 150

fpm was 12 per cent, at 200 fpm, it was 34 per cent and at 300 fpm the improvement was approximately 150 per cent.

It should be mentioned also that the improvement in machinability which results from deoxidation is accomplished without detriment to the physical properties or other characteristics of the castings. In these machining tests the deoxidized irons were equal or superior to the undeoxidized base irons in strength and elasticity.

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AFS Apprentice Contest Is Under Way

American Foundrymen's Society apprentice contest, sponsored by the apprentice contest committee, AFS Education Division of the society, 616 South Michigan Ave., Chicago 5, is under way. Apprentices and students of trade, vocational and high schools are eligible. Entrants are not required to be members of AFS.

Local contests will be sponsored by AFS chapters or by individual plants, and the best three entries will be selected in gray iron, steel, and nonferrous castings, and wood and metal patterns. Castings and patterns entered in the national contest must reach the place designated for national judging not less than 30 days prior to opening of the society's annual convention in Buffalo, Apr. 23.

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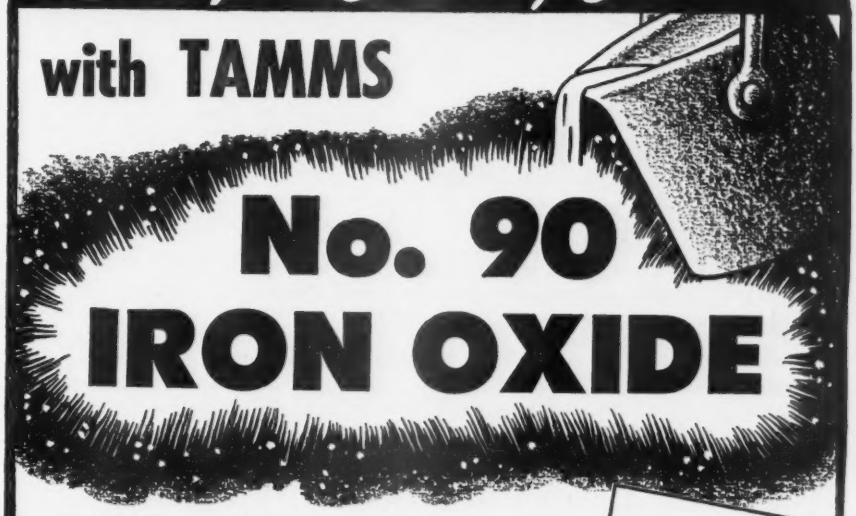

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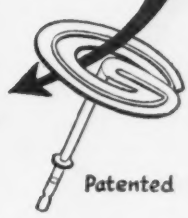
Core Holding
POWER

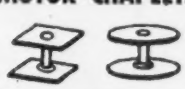


Patented

A chaplet cannot hold cores firmly unless it is held rigidly. The open head of this chaplet permits you to pack sand better under the head and around stem. *Write for Bulletin.*

CLEVELAND CHAPLET & MFG. CO.
1197 W. 67th St., Cleveland, Ohio

We also make MOTOR CHAPLETS

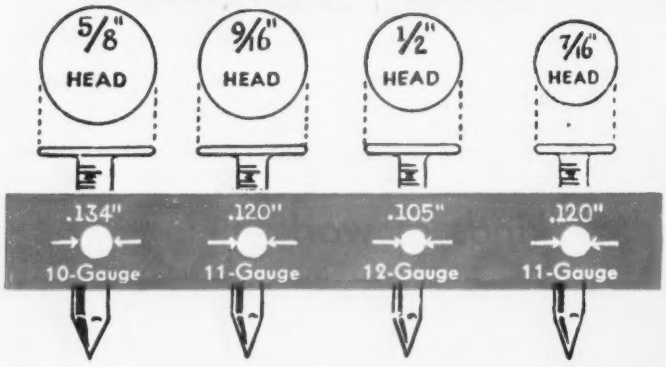


BOILER CHAPLETS,
FORGED HEAD CHAPLETS,
FITTED HEAD CHAPLETS,
DOUBLE HEAD CHAPLETS
and other types.

CLEVELAND *Chaplets*
Since 1890

ANGELL . . . PROVEN PRESSURE PROOF CHAPLETS

Producers of SUPER HEAD FOUNDRY NAILS



⅜", 9/16" & ½" Heads available up to 3 inches in length

Standard Foundry Nails available in all lengths.

All styles of Chaplets Accurately Made for Better Castings

THE ANGELL NAIL & Chaplet Company

4580 East 71st Street
CLEVELAND 5, OHIO

No. 4 DAYTON RING VALVE BENCH RAMMER

MORE POWER—MORE SPEED

You'll get more production with these faster, more powerful rammers and at the same time substantially reduce maintenance costs.

The Valve Units will last for years. The Cylinder Bores and Piston Rods are HARD CHROME PLATED which doubles the life of the Rammer. Many of the largest foundries in the country have already adopted them as standard. Made in six sizes to meet every requirement.

Send for Bulletin 300

DAYTON PNEUMATIC TOOL CO.

Manufacturers of Pneumatic Tools Since 1903

DAYTON, OHIO

HAUCK OIL AND GAS BURNING EQUIPMENT

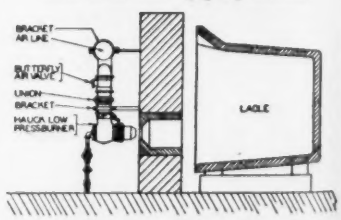
for
- CUPOLA LIGHTING
- MOLD DRYING
- LADLE HEATING
- CORE BAKING
- FURNACE HEATING

Compressed air portable oil burner equipment for lighting cupolas and drying molds. Also hand pump types.

Venturi compressed air "suction" hand torches — no preheating, for drying linings, cores, molds.

Portable venturi high pressure oil burners with adjustable burner stand for heating and drying ladles.

Featuring
Stationary Ladle Heating Oil Burner Equipment



Using Hauck Venturi Low or High Pressure Air Type Oil Burners for heating or drying ladles with speed and economy in gray iron, steel and non-ferrous foundries. Employ wall, cover or down firing method. We engineer the entire application and piping layout. Write for Hauck Foundry Burner Equipment Catalog.

HAUCK MANUFACTURING CO.
106 Tenth St., Brooklyn 15, N. Y.

Venturi low pressure and high pressure air atomizing oil burners for ladle heating, core and mold ovens, melting and annealing furnaces.

Screenarators
Molding Machines
Quick Draw Strippers
Revolving Mold Conveyors
Brass Furnaces · Electric Riddles
Mullors · Core Binders · Cupola Patch
Wire Straightening Machines · Ladle Bowls
Geared Ladles · Seacoal
Sand Blasting Cabinets
Grinders · Sprue Cutters
Core Blowers
Core Oils
Ladles
Flasks
Sand

Everything for a Foundry

Vibrators
Jackets
Hoists
Riddles
Sand
Fluxes
Ladles
Core Pastes
Plumbago
Crucibles
Grinders
Steel Abrasives
Screenarators
Core Ovens
Sand Mixers
Sand Slingers
Stationary Melting Furnaces
Core Cutting-off Machines
Tilting Crucible Furnaces
Parting Compounds
Hoists
Tumbling Mills
Core Ovens
Core Washes
Shovels
Chaplets
Bellows
Mullors
Furnaces

Listed here are just a few of the hundreds of foundry items furnished by Frederic B. Stevens, Inc. There are more than 600 pages in the Stevens Catalog #30 devoted to foundry equipment and supplies. Whatever your foundry needs—from a moulder's tool to a cupola—Stevens is a ready, dependable source of supply. Call in your nearby Stevens representative before you make your next purchase. You'll find him a big help in saving you time and money. Or write direct to Frederic B. Stevens, Inc., Detroit 16, Mich.

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INCORPORATED

FREDERIC B. STEVENS OF CANADA, LTD.
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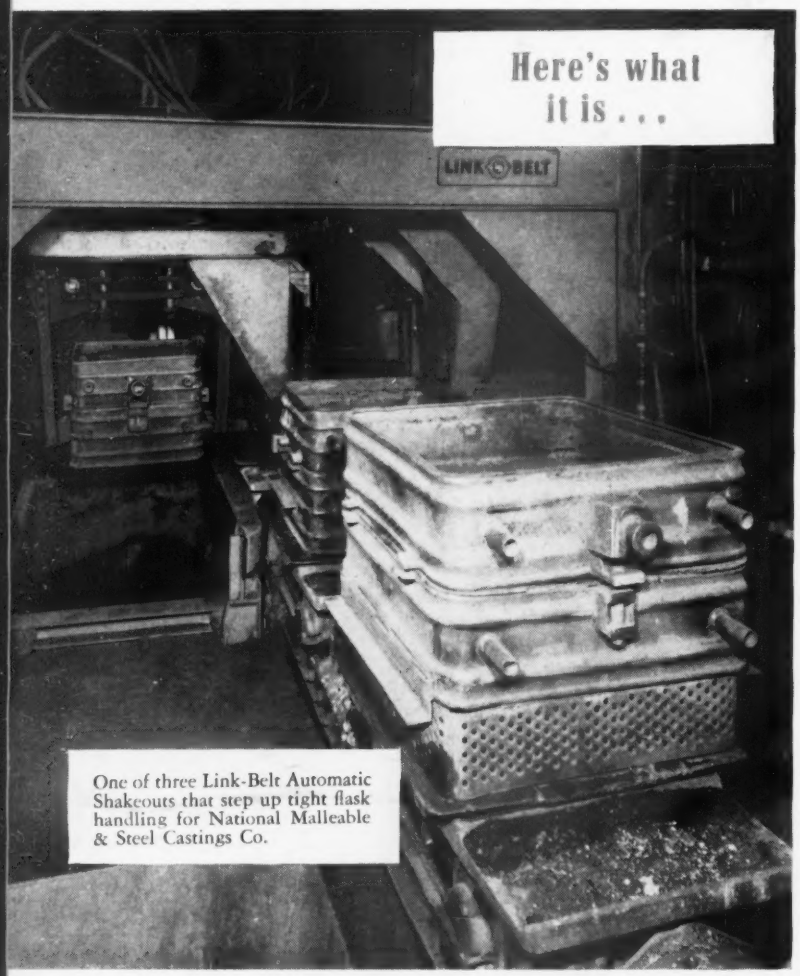
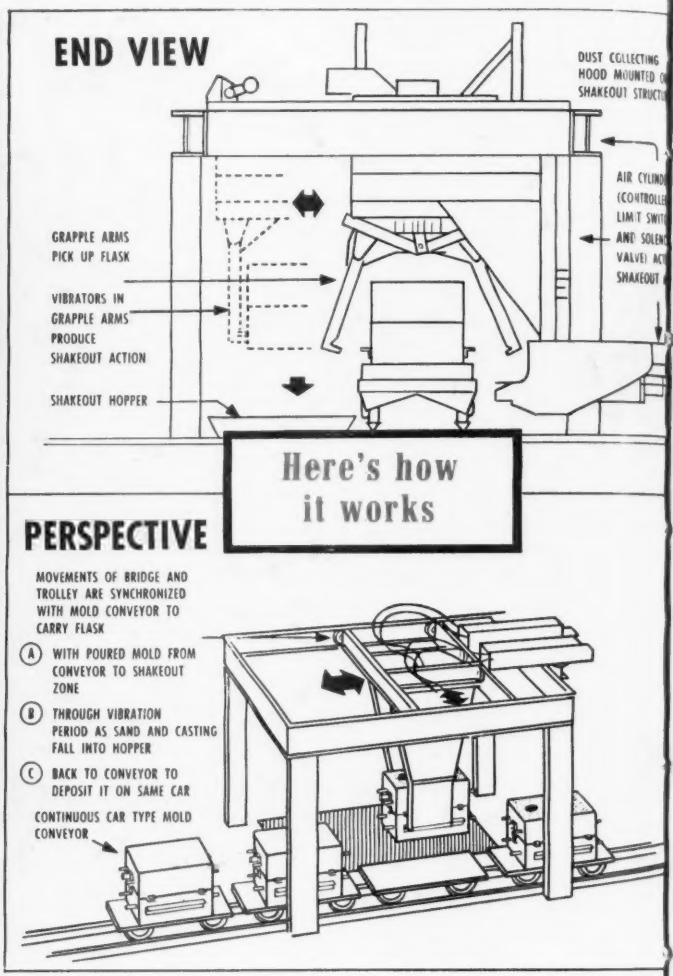
Conserve valuable manpower with the *New* LINK-BELT AUTOMATIC SHAKEOUT



One of three Link-Belt Automatic Shakeouts that step up tight flask handling for National Malleable & Steel Castings Co.


END VIEW
DUST COLLECTING HOOD MOUNTED ON SHAKEOUT STRUCTURE
AIR CYLINDERS (CONTROLLED BY LIMIT SWITCHES AND SOLENOID VALVE) ACTUATE SHAKEOUT
GRAPPLE ARMS PICK UP FLASK
VIBRATORS IN GRAPPLE ARMS PRODUCE SHAKEOUT ACTION
SHAKEOUT HOPPER
Here's how it works
PERSPECTIVE
MOVEMENTS OF BRIDGE AND TROLLEY ARE SYNCHRONIZED WITH MOLD CONVEYOR TO CARRY FLASK
(A) WITH POURED MOLD FROM CONVEYOR TO SHAKEOUT ZONE
(B) THROUGH VIBRATION PERIOD AS SAND AND CASTING FALL INTO HOPPER
(C) BACK TO CONVEYOR TO DEPOSIT IT ON SAME CAR
CONTINUOUS CAR TYPE MOLD CONVEYOR

Completely mechanized . . . frees workmen from hazardous shakeout zone

One look at the Link-Belt Automatic Shakeout at work and you'll see why it improves production . . . and frees valuable manpower for other jobs. This revolutionary machine picks up a flask with poured mold from each car, moves it sideways over shakeout hopper and vibrates it to discharge sand and casting to a conveyor below. The grapple arms then return the empty flask to its car, having been keyed by a synchronizing bar to the car to insure travel at the same speed.

You get completely automatic operation on a variety of tight flask molds at rates up to four per minute. What's more, the Link-Belt Automatic Shakeout requires a minimum of head room—less than is often required with conventional hoists, etc. . . . actually frees a workman from the hazardous shakeout zone to do other related work. Result: greater efficiency, more production, better working conditions.

Find out how the Link-Belt Automatic Shakeout can pay for itself in your foundry. Write Link-Belt, or contact:

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices in Principal Cities. 12,221

FOUNDRY EQUIPMENT MEMBER FEMA MANUFACTURERS ASSOCIATION INC.

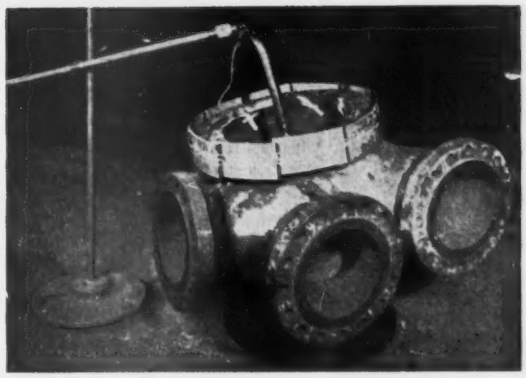
LINK-BELT

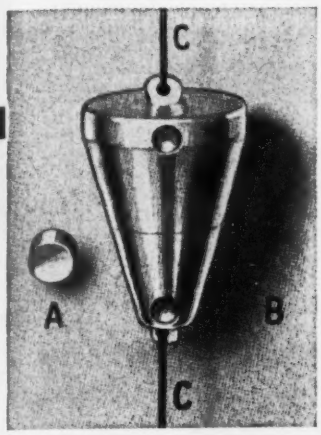
THE SYMBOL OF QUALITY · LINK-BELT · LB

HANDLING AND SAND PREPARATION EQUIPMENT

BUY, RENT OR LEASE OUR RADIUM RADIOGRAPHY KIT

and make a short cut to more productive and economical foundry practice





The apparatus is as simple as
A—small radium capsule
B—cartridge container
C—rigid string support

The use of gamma rays in radiographing steel castings has increased by leaps and bounds since 1930, when the first commercial use of radiography was marked by a picture of the sternpost of the cruiser "Chester". Radium radiography is simple, economical and effective; because it may be rented or leased, the equipment doesn't require a capital investment. Because it is simple to operate, it doesn't require especially skilled operators. By 1948 200 steel foundries were renting or leasing radium from the Radium Chemical Co., Inc., and today radium radiography is rapidly approaching the status of standard equipment in progressive steel foundries. Photograph shows a simple method for radiographing a flange on a heavy steel casting. Let us tell you more about the simplicity and economy of radium radiography; write today for prices, terms and case histories.

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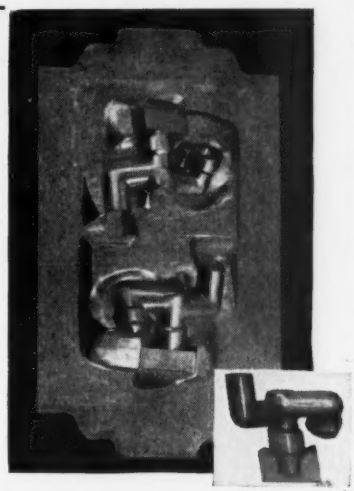
Where Production is the first Consideration, Pressure Cast Aluminum Matchplates and Cope and Drag Plates are the only Satisfactory Answer



Only one master pattern does it! From it we make you single or multiple pattern matchplates, casting them under pressure in plaster molds. Why not find out exactly how much we can save you by this method, or by furnishing cope and drag plates which likewise jump production and lower your costs?

Get our quotations today.

TOLEDO MATCHPLATE COMPANY
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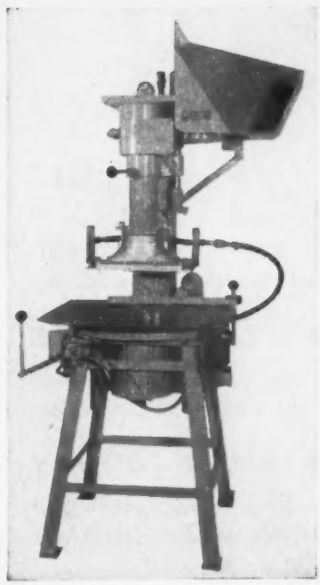
AFFILIATE: PLASTER PROCESS CASTINGS CO.
6922 Carnegie Ave., Cleveland 3, Ohio

Pressure-Cast MATCHPLATES
COPE and DRAG PLATES

◂COR-BLO▸ AUTOMATIC



HIGH DRAW MODEL "C-H-E"

Cores up to 8 lbs.

With the operation of one lever on the hand machine, or pushing of one button on the electric cycle, this machine will —Close the Core Box—Blow the Cores—Vibrate the Box—Draw the Cores—and Eject the Core Box to position where the dryer is applied. Produces more cores with less operator fatigue, and more cores per hour.

Let us figure on your requirements.

HARRISON MACHINE COMPANY
Wesleyville, Erie, Pa.

GLUTRIN
LIQUID BINDER

GOULAC
DRY BINDER

For
CORE WORK, SAND FACINGS, SPRAYS

Write for pamphlets giving detailed information. Both materials carried in stock by America's foremost foundry jobbers

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(Established 1905)

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(Established 1915)

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Master Power
HARD CHROMED • PORTABLE PNEUMATIC TOOLS

DO MORE WORK AT LESS COST
because they deliver more power per cubic foot of air consumed, are light in weight for easier maneuverability and they retain their new tool power longer.

ARE PREFERRED BY OPERATORS
because they are lighter in weight, better balanced and designed to reduce shock and be free from vibration.

IF YOUR PROBLEM INCLUDES
chipping, ramming, grinding, buffing, sanding or wire brushing, *write us today for full particulars.*

THE MASTER PNEUMATIC TOOL COMPANY, INC.
ORWELL, OHIO • U. S. A.
SALES • SERVICE • STOCK • COAST TO COAST

This Winter
AVOID
FROZEN AIR LINES

Moisture entrained in compressed air condenses readily at low temperatures, and freezes before it can be ejected by ordinary traps. But Thermotrap (by Murphy) is built with a 50 watt thermal head which keeps the condensate fluid and ejects it automatically as collected. There is a size and style to suit ***your*** application.

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At a price far below the cost of one freeze-up you can install Thermotrap at vulnerable spots in your compressed air system and ***avoid*** the danger, worry, and expense of frozen air lines. For Thermotrap keeps ***automatic, care-free*** guard when temperatures tumble. Install it and forget it.

Write today for the six page Thermotrap folder which gives full information. ***This winter—avoid*** frozen air lines.

GUARANTEED COMPRESSED AIR PRODUCTS

AFTERCOOLERS • SEPARATORS • STRAINERS • TRAPS
SPRAY GUNS • PISTOL SPRAYERS

JAS. A. MURPHY & CO.
FIFTH AND VINE STREETS, HAMILTON, OHIO
Moisture Elimination Up To 3000 Pounds Per Square Inch

Bank Your Sand Savings

WITH A NICHOLS SAND RECLAMATION SYSTEM

1. LOW OPERATING COSTS
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4. NO DISPOSAL PROBLEMS

These Nichols Features Are Money Savers

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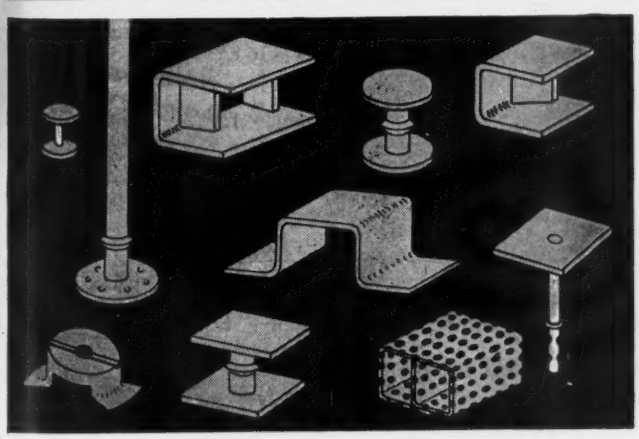
There's always one Chaplet that's best for each job

ARE YOU SURE YOU'RE USING IT?

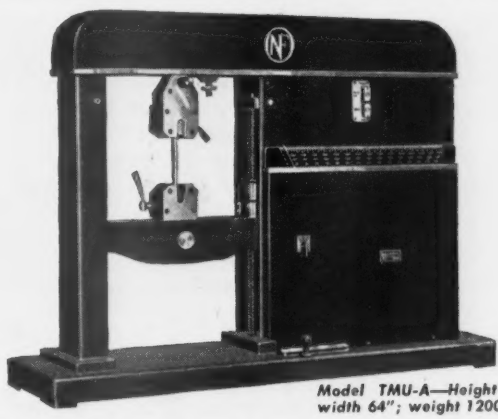


The large variety of "Buffalo" Chaplet designs enables you to meet your needs *exactly*. Given this broad selection, you are always assured of greater strength, easier burning-in and higher resistance to chilling for each specific job.

CATALOG NO. 15 offers complete details on designs, sizes and gauges. Copies mailed promptly. Samples of any "Buffalo" Chaplet will be gladly furnished.

Combined SUPPLY & EQUIPMENT CO., INC.
211 CHANDLER ST., BUFFALO 7, N. Y.

It Will Pay to Make Your Own Tests with NATIONAL FORGE UNIVERSAL TESTING UNITS



Model TMU-A—Height 44"; width 64"; weight 1200 lbs.

The National Forge Universal Testing Machine, Model TMU, is compact, accurate, dependable, easy to operate and moderately-priced.

Wide working clearances, long stroke, quick-action simplified variable-speed control, improved grips and a wide spread of load scale ranges adapt this modern, streamlined unit to production, research or school instruction tests of a great variety of materials and specimen sizes. A.S.T.M. accuracy requirements are guaranteed.

Three load scale ranges: Model TMU-A—0-30,000, 0-6000, 0-600 lbs. Model TMU-B—0-15,000, 0-3000, 0-300 lbs.

For details, write for Brochure 501.

TESTING MACHINE DIVISION
NATIONAL FORGE & ORDNANCE COMPANY
Dept. F Irvine, Warren County, Penna.

MIX CORE SANDS MOLDING SANDS CUPOLA PATCH MIXES IN 4 MINUTES FLAT

THEN *DISCHARGE 'EM* IN THIRTY SECONDS

Lower Costs? YOU BET!

It's the new PERFECT MIX MULTIMIXER that kneads, as it turns, as it rubs to give you the most modern equipment of its kind on the market today for better cores—better castings. Sizes from 3 to 60 cu. ft. Hundreds of units in operation. Direct motor drive—no clutch—no belts. A real time saver—cost cutter.

Sold only through nationally known foundry and equipment dealers. Consult your supply dealer or write direct.

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JISCO SILVERY PIG IRON

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Smelted from Superior quality lake ores, high grade metallurgical coke and limestone, using our own local No. 1 Sharon Seam coal.

HIGH SILICON IRON JISCO

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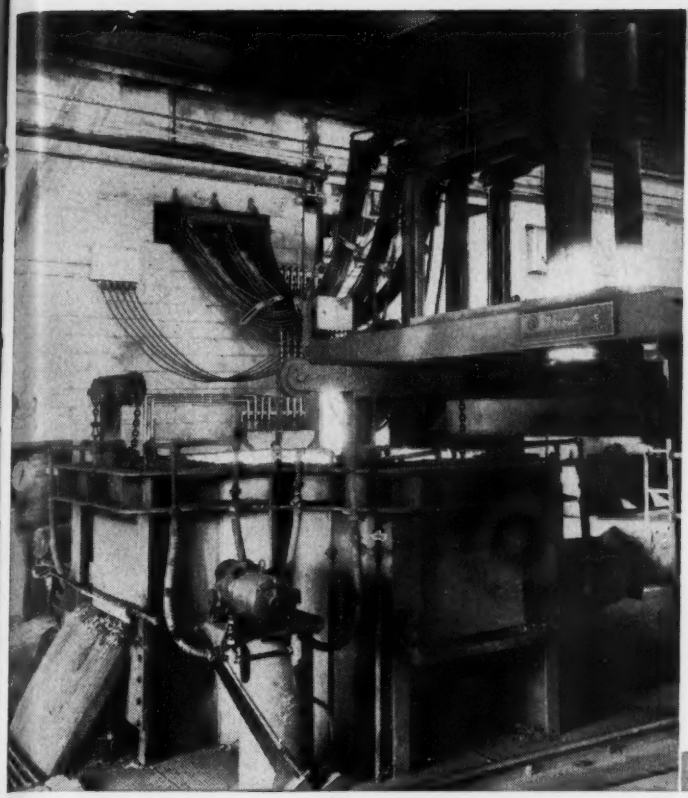

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Precision-built, gear-driven mechanisms for maximum safety and dependability.

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UNITED STATES STEEL

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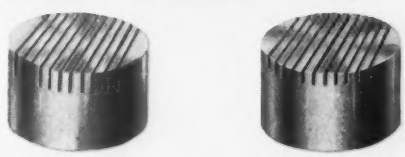
INSERTING DRILL

• Uniformity of holes • Faster insertion of vent
• Correct Depth

CORE BOX VENTS



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Wide or Narrow Slots
.014 .010

SHALLOW HEAD
Wide or Narrow Slots
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Made of Tempered Steel, Easy to Use

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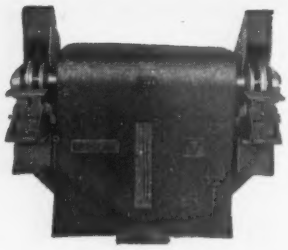
TOOLS • PRECISION MACHINED and GROUND PARTS • FIXTURES



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You Can Cut Your *Wheel Costs* With A MARSCHKE GRINDER!

Every grinder in the Marschke line is built with two objectives in mind: (1) to give you a machine which will get the most work and the longest wear out of your grinding *wheels;* and (2) give you a machine with long, reliable and trouble-free service. The first is achieved through *elimination of vibration;* the second, through *quality materials* and engineering know-how.

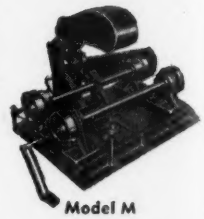
The name "Marschke" means more than just quality, it means a complete *line* of grinding tools, adaptable to the solution of any grinding problem. Give us information on what you're up against, maybe we can suggest a solution.

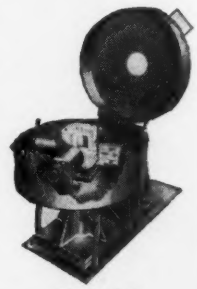
VONNEGUT
MOULDER CORPORATION
1839 MADISON AVENUE • INDIANAPOLIS 25, INDIANA

CENTRIFUGAL CASTING MACHINES

Model AS

Model J


Model M


Model J-P

These machines used to make ferrous and non-ferrous centrifugal castings are produced by the pioneer manufacturer of such equipment.

They are made in a large variety of styles and a wide range of sizes. Complete technical information is supplied concerning sand and permanent mold design, gating, sand mixes, speeds, etc.

Send us drawings or sketches of parts you are interested in casting centrifugally, and we will tell you, without obligation, if and how our machines can cast them faster, cleaner and with fewer rejects.

CENTRIFUGAL CASTING MACHINE COMPANY
Nathan Janco, *President*
P. O. Box 947 Tulsa 1, Okla.

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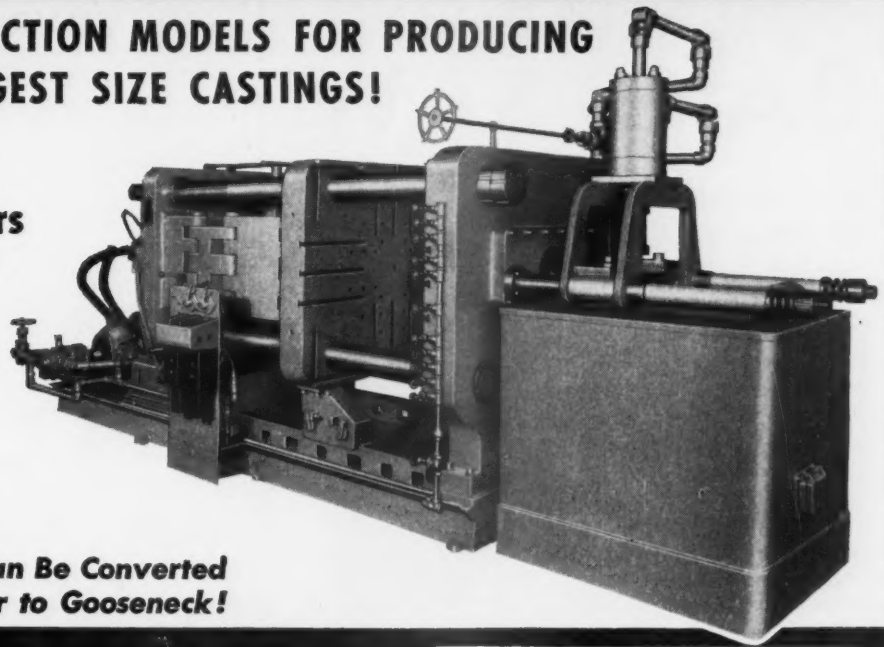

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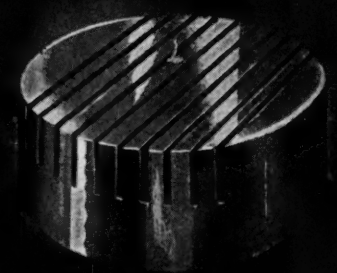

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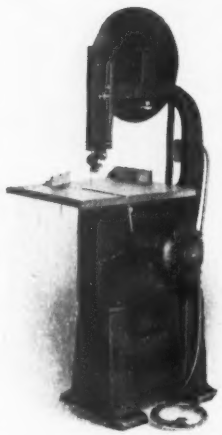

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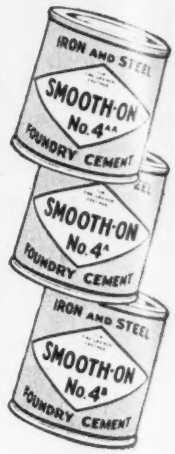

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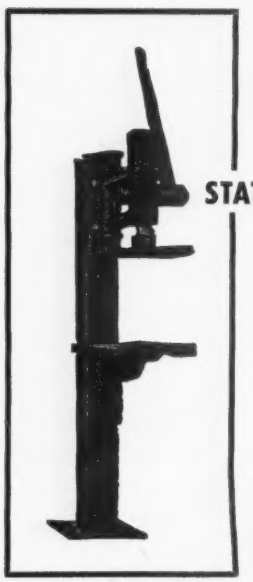

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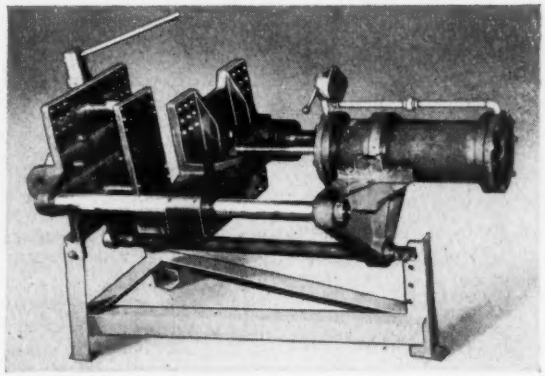

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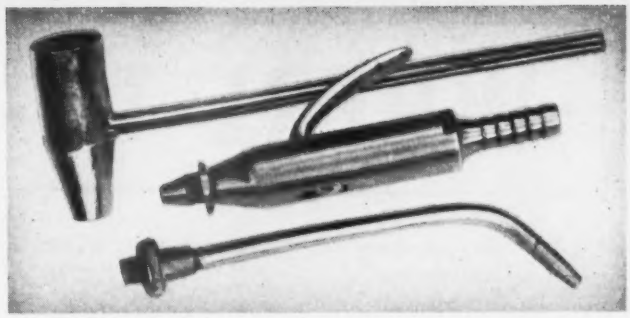

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Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

CASTINGS

City Pattern Foundry & Machine Co., 1165 Harper Ave., Detroit 11, Mich.

CASTING MACHINES (Centrifugal)

Centrifugal Casting Mach. Co., Tulsa, Okla.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.

CASTING MACHINES (Permanent Mold)

Centrifugal Casting Machine Co., Tulsa, Okla.

CASTING SEALER

Empire Varnish Co., 2636 E. 76th St., Cleveland 4, Ohio.
Tousey Varnish Co., 520 West 25th St., Chicago 16, Ill.

CEMENT (Metallic)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.
Smooth-On Manufacturing Co., 570 Communipaw Ave., Jersey City 4, N. J.

CEMENT (Refractory)

Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Building, Buffalo 2, N. Y.
A. P. Green Fire Brick Co., Mexico, Missouri.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Ironton Fire Brick Co., Ironton, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Mexico Refractories Co., Mexico, Mo.
Norton Co., Worcester 6, Mass

CEREAL BINDERS

Chas. A. Krause Milling Co., 404 East State St., Milwaukee, Wis.

CHAIN (Hoist, Conveyor, Drive, Sling, etc.)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

CHAIN (Steel Loading)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

CHAIN (Welded and Weldless)

Chisholm-Moore Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
McKay Co., 1005 Liberty Ave., Pittsburgh 22, Pa.

CHAINS (Sling)

McKay Co., 1005 Liberty Ave., Pittsburgh 22, Pa.

CHAPLETS

Angell Nail & Chaplet Co., 4580 E. 71st St., Cleveland, Ohio.
Cleveland Chaplet & Mfg. Co., 1197 W. 67th St., Cleveland 2, O.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7, N. Y.
Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.
Fanner Mfg. Co., Brookside Park, Cleveland 2, Ohio.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O
Milwaukee Chaplet & Mfg. Co., 1023 S. 40th St., Milwaukee 4, Wis.
Frederic B. Stevens, Inc., Detroit 16, Mich.

CHARCOAL

Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.

CHEMICALS

Atlantic Chemical & Metals Co., 1925 N. Kenmore, Chicago 14, Ill.
Hercules Powder Co., Wilmington 99, Del.
Wm. F. Jobbins Co., Aurora, Ill.
Mathieson Chemical Corp., Mathieson Bldg., Baltimore 3, Md.
Monsanto Chemical Co., 1700 S. 2nd St., St. Louis 4, Mo.

CHEMISTS

Crobaugh Co., Frank L., 1426 West Third St., Cleveland 13, Ohio.

CHILLS

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
Angell Nail & Chaplet Co., 4580 E. 71st St., Cleveland, Ohio.
Fanner Mfg. Co., Brookside Park, Cleveland 2, Ohio.
Milwaukee Chaplet & Mfg. Co., 1023 So. 40th St., Milwaukee 4, Wis.
Standard Horse Nail Corp., New Brighton, Pa.

CHILL COATINGS

Acheson Colloids Corp., Port Huron, Mich.

CHILL NAILS

Angell Nail & Chaplet Co., 4580 E. 71st St., Cleveland, Ohio.
Capewell Mfg. Co., Hartford, Conn.
Standard Horse Nail Corp., New Brighton, Pa.

CHIPPERS—See PNEUMATIC TOOLS

CHISELS (Chipping)

Arrow Tools, Inc., 1900 S. Kostner, Chicago, Ill.
Cleco Division of Reed Roller Bit Co., Houston, Texas.

CHROMIUM (Briquets)

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

CLAMPS (Flask)

Diamond Clamp & Flask Co. Richmond, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Sterling Wheelbarrow Co., 1700 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

CLAY (Bonding)

American Colloid Co., Merchandise Mart Plaza, Chicago 54, Ill.
Carpenter Brothers, Inc., 606 West Wisconsin 3, Mo.
Baroid Sales Division, 830 Ducommun St., Los Angeles 12, Calif.
Eastern Clay Products, Inc., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.
Ironton Fire Brick Co., Ironton, O.

CLAY (Refractory)

Carpenter Brothers, Inc., 606 West Wisconsin 3, Mo.
Eastern Clay Products Inc., Jackson, O.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.
Chas. Taylor Sons Co., P. O. Box 58, Annex Sta. Cincinnati 14, Ohio.

CLAY STORAGE BINS

Neff & Fry, Camden, O.

CLEANING COMPOUNDS

Pelron Corp., 7740 West 47th St., Lyons, Illinois

CLEANING EQUIPMENT (Castings)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Arrow Tools Inc., 1900 S. Kostner, Chicago, Ill.
Pangborn Corp., Hagerstown, Md.

CLUTCHES (Magnetic)

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.,
Stearns Magnetic Mfg. Co., 622 S. 28th St., Milwaukee 4, Wis.

COAL STORAGE BINS

Neff & Fry, Camden, O.

COBALT (Radio Active)

Eldorado Mining & Refining Ltd., P. O. Box 379, Ottawa, Ont.

COKE (Foundry)

DeBardeleben Coal Corp., 2201 First Ave., N., Birmingham 3, Ala.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Pickands, Mather & Co., Cleveland 14, O.
Republic Coal & Coke Co., 8 So. Michigan Ave., Chicago 3, Ill.
Semet Solvay Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.
Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.

COKE (Petroleum)

Republic Coal and Coke Co., 8 S. Michigan Ave., Chicago 3, Ill.

COLLECTORS (Dust)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Air Filter Co., 266 Central Ave., Louisville 8, Ky.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland, O.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Pangborn Corp., Hagerstown, Md.
Schneible Co., Claude B., 2827 25th St., Detroit 16, Mich.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

CONCRETE STORAGE BINS

Neff & Fry Co., Camden, O.

CONTROL SYSTEMS (Dust)

American Air Filter Co., 223 Central Ave., Louisville, Ky.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

CONVERTER BLOWERS

Roots-Connersville Blower Corp., Connersville, Ind.

CONVERTERS (Bessemer)

Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

CONVEYOR DESIGN

Giffels & Valet, Inc., Marquette Bldg., Detroit, Mich.

CONVEYORS (Apron)

Logan Co., 580 Cabel, Louisville, Ky.

CONVEYORS (Belt)

Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The 2424 No. Cicero, Chicago 39, Ill.
Boston Woven Hose & Rubber Co., 29 Hampshire, Cambridge 39, Mass.
Imperial Belting Co., 1800 So. Kilbourn Ave., Chicago 23, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Chain)

Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., 104 Tenth St., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Gravity)

Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., 104 Tenth St., Ellwood City, Pa.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Live Roller)

Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Magnetic)

Stearns Magnetic Mfg. Co. 662 S. 28th St., Milwaukee 4, Wis.

CONVEYORS (Monorail)

American Monorail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 E. 283rd St., Wickliffe, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Mathews Conveyer Co., 104 Tenth St., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Penn Iron Works, Reading, Pa.

CONVEYORS (Overhead)

Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

CONVEYORS (Pneumatic)

Fuller Company, Catasauqua, Pa.

CONVEYORS (Portable)

Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

CONVEYORS (Portable-Gas Electric)

Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

CONVEYORS (Rubber)

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Vibrating)

Ajax Flexible Coupling Co., Westfield, N. Y.
Jeffrey Mfg. Co., 907 N. Fourth St., Ciumbus 16, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Simplicity Engineering Co., Durand, Mich.
Syntron Company, Homer City, Pa.

COPPER

Federal Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

COPPER SHOT

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

CORE BINDERS

American Gum Products Co., 500 Fifth Ave., New York 18, N. Y.
Archer-Daniels-Midland Co., Werner G. Smith Div., 2191 W. 110th St., Cleveland 2, O.
Bakelite Corp., 300 Madison Ave., New York 17, N. Y.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Corn Products Sales Co., 17 Battery Pl., New York 4, N. Y.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
General Electric Co., Pittsfield, Mass.

CORE BINDERS (Cont'd.)

Hercules Powder Co., Wilmington 99, Del.
E. F. Houghton Co. 303 W. Lehigh Ave., Philadelphia 33, Pa.
Chas. A. Krause Milling Co., 404 E. State St., Milwaukee 1, Wis.
Monsanto Chemical Co., Plastic Division, Springfield 2, Mass.
Pelron Corp., 7740 West 47th St., Lyons, Illinois
Robeson Process Co., 500 Fifth Ave., New York 18, N. Y.
Frederic B. Stevens, Inc., Detroit 16, Mich.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
Werner G. Smith, Inc. Union Commerce Bldg., Cleveland 14, Ohio.

CORE BLOWER BUSHINGS

Eastern Clay Products, Inc. Jackson, Ohio.
Martin Engineering Co., Kewanee, Ill.

CORE BLOWING MACHINES

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Wm. Demmler & Bros., Kewanee, Ill.
Federal Foundry Suppy Co., 4600 E. 71st St., Cleveland 5, O.
Harrison Machine Co., Wesleyville, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Redford Iron & Equipment Co., 20733 Glendale Ave., Detroit 23, Mich.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

CORE BOXES

Accurate Match Plate Co., 1847 W. Caroll St., Chicago, Ill.

CORE COLORING

Eaton Chemical & Dyestuff Co. 1490 Franklin, Detroit, Mich

CORE COMPOUND

Archer-Daniels-Midland Co., Werner G. Smith Div., 2191 W. 110th St., Cleveland 2, O.
Bakelite Corp., 300 Madison Ave., New York 17, N. Y.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Pelron Corp., 7740 West 47th St., Lyons, Illinois
Frederic B. Stevens, Inc., Detroit 16, Mich.
Werner G. Smith, Inc., Union Commerce Bldg., Cleveland 14, O.

CORE DRAWER

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.

CORE DRAWING MACHINES

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Freeman Supply Co., Toledo 5, O.
Newaygo Engineering Co., Newaygo, Mich.

CORE DRIERS (Dielectric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

CORE FLUXES (Aluminum, Magnesium)

Pelron Corp., 7740 West 47th St., Lyons, Illinois

CORE GRINDERS (Power Operated)

Jeffrey Mfg. Co., Columbus 16, O.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Standard Pattern Works, 6771 E. McNichols, Detroit 12, Mich.
Sutter Products Co., Dearborn, Mich.

CORE KNOCKOUT MACHINES

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Pangborn Corp., Hagerstown, Md.
Simplicity Engineering Co., Durand, Mich.

CORE MAKING MACHINES

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Wm. Demmler & Bros., Kewanee, Ill.
Federal Foundry Suppy Co., 4600 E. 71st St., Cleveland 5, O.
Harrison Machine Co., Wesleyville, Pa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Redford Iron & Equipment Co., 20733 Glendale Ave., Detroit 23, Mich.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Wadsworth Equipment Co., 560 Lafollette St., Akron, Ohio.

CORE OILS

Archer-Daniels-Midland Co., Werner G. Smith Div., 2191 W. 110th St., Cleveland 2, O.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Pelron Corp., 7740 West 47th St., Lyons, Illinois
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Frederic B. Stevens, Inc., Detroit 26, Mich.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
Werner G. Smith, Inc., Union Commerce Bldg., Cleveland 14, Ohio.

CORE OVENS

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, O.
Despatch Oven Co., Minneapolis 14, Minn.
Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, O.
Girdler Corp., Thermex Division, 224 E. Broadway, Louisville 2, Ky.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Induction Heating Corp., 181 Wythe Ave., Brooklyn 11, New York
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Porbeck Mfg. Co., 2600 N. 9th St., St. Louis 6, Mo.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

CORE PASTE

Corn Products Sales Co., 17 Battery Pl., New York 4, N. Y.
Delta Oil Products Co., Milwaukee 9, Wis.
Eastern Clay Products Co., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

CORE PLATES (Steel, Asbestos)

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Johns-Manville, 22 E. 40th St., New York 16, N. Y.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

CORE ROD STRAIGHTENING and CUTTING MACHINERY

American Wheelabrator & Equipment Co., Mishawaka, Ind.

CORE SAND

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Ottawa Silica Co., Ottawa, Ill.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Weldron Silica Co., 38 So. Dearborn St., Chicago, Ill.

CORE SAND MIXERS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Clearfield Machine Co., Clearfield, Pa.
Federal Foundry Supply Co., 4600 E.71st St., Cleveland 5, Ohio.
Multiplex Machinery Corp., Elmore, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Posey Iron Works Inc., Lancaster, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

CORE SPRAYERS

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.

CORE STRIPPERS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE TRAYS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

CORE TRUCKS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

CORE VENTS

Demmler, Wm., & Bros., Kewanee, Ill.
Smillie, C. M. & Co., 1124 Woodward Heights Blvd., Ferndale 20, Mich.
United Compound Co., Inc., 328 South Park Ave., Buffalo 4, N. Y.

CORE WASH

Asbury Graphite Mills, Asbury, N. J
Bloomsbury Graphite Co., Bloomsbury, N. J.
Carborundum Co., Perth Amboy, N. J.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Corn Products Sales Co., 17 Battery Pl., New York City 4.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Stevens, Frederic B., Inc., Detroit 26, Mich.
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
United States Graphite Co., Saginaw, Mich.

CORE WIRE CUTTERS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE WIRE STRAIGHTENERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE WIRES

Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.

CORES (Annealing)

Pressed Steel Co., Wilkes-Barre, Pa.

COUPLINGS (Air Line)

Cleco Division of Reed Roller Bit Co., Houston, Tex.

COUPLINGS (Flexible)

Ajax Flexible Coupling Co., Westfield, N. Y.

CRANE LUBRICATING SYSTEMS

Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh, Pa.

CRANES (Bucket)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Electric Tramrail)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

CRANES (Electric Traveling)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Erie Steel Construction Co., Erie, Pa.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Shepard-Niles Crane & Hoist Corp., 360 Schuyler Ave., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Gantry)

Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Wellman Engineering Co., 7000 Central Ave., Cleveland 4, O.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Hand Traveling)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, Ohio.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Jib)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Monorail)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., 360 Schuyler Ave., Montour Falls, N. Y.

CRANES (Self-Propelled)

Silent Hoist & Crane Co., 835 63rd St., Brooklyn 20, N. Y.

CRANES (Traction or Tractor)

Silent Hoist & Crane Co., 835 63rd St., Brooklyn 20, N. Y.

CRUCIBLES

American Crucible Co., North Haven, Conn.
Bay State Crucible Co., Taunton, Mass.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Lava Crucible Co., Pittsburgh, Pa.
Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.
Vesuvius Crucible Co., Swissvale, Pa.

CRUCIBLE FURNACES

Ajax Electrothermic Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

CRUCIBLE LIFTERS

Modern Equipment Co., Port Washington, Wis.

CRUCIBLE POURING DEVICES

Modern Equipment Co., Port Washington, Wis.

CRUSHERS (Core)

Simplicity Engineering Co., Durand, Mich.

CUPOLAS

Modern Equipment Co., Port Washington, Wis.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA BLOWERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Roots-Connersville Blower Corp., Connersville, Ind.
Spencer Turbine Co., Hartford, Conn.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA CHARGING MACHINES

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA CONTROL EQUIPMENT

Edwin S. Carman, 1643 Lee Road, Cleveland 18, Ohio.
Foxboro Company, Foxboro, Mass.

CUPOLA DUST ARRESTORS

Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.

CUPOLA LININGS

Carborundum Co., Perth Amboy, N. J.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.
A. P. Green Fire Brick Co., Mexico, Missouri.
Ironton Fire Brick Co., Ironton, O.
United States Graphite Co., Saginaw, Mich.

CUPOLA PATCHING GUNS

Eastern Clay Products, Inc., Jackson, Ohio.

CUPOLA SPARK ARRESTORS

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUTOFF MACHINES (Abrasive)

Fox Grinders Inc., Oliver Bldg., Pittsburgh, Pa.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

CYLINDERS (Hydraulic)

Miller Motor Co., 4027 N. Kedzie, Chicago 18, Ill.

DARK ROOM ACCESSORIES (X-Ray)

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

DARK ROOM PROCESSING (Chemical Tanks, etc.)

Eastman Kodak Co., Rochester, N. Y.

DEGASIFIERS

Metalloy Corp., Rand Tower, Minneapolis 2, Minn.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

DEOXIDIZERS

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.
Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Metalloy Corp., Rand Tower, Minneapolis 2, Minn.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.

DEOXIDIZERS (Ferrous)

Carborundum Co., Perth Amboy, N. J.

DESULPHURIZERS

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Hercules Powder Co., Wilmington 99, Del.
Mathieson Chemical Corp., 60 Mathieson Bldg., Baltimore 3, Md.
Modern Equipment Co., Port Washington, Wis.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
Solvay Sales Division Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

DIE CASTING MACHINES

Kux Machine Co., 3930 W. Harrison St., Chicago 24, Ill.
Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.
Miller-Taylor Tool Co., 5005 Euclid Ave., Cleveland 3, Ohio.

DIES

City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.

DIRECT FIRED HEATERS

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

DOWEL PINS

Standard Horse Nail Corp., New Brighton, Pa.

DRILLS (Pneumatic)

Gardner-Denver Co., Quincy, Ill.
Schramm Inc., West Chester, Pa.

DRIVES (Reciprocating)

Ajax Flexible Coupling Co., Westfield, N. Y.

DRUMS (Magnetic)

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

DRYERS

Porbeck Mfg. Co., 2600 N. 9th St., St. Louis 6, Mo.

DRYING OVENS

Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.

DUMP HOPPERS

Roura Iron Works, 1405 Woodland Ave., Detroit 11, Mich.

DUMP TRUCKS

Frank G. Hough Co., Libertyville, Ill.
Kwik-Mix Co., Port Washington, Wis.
Prime Mover Co., Muscatine, Iowa.

DUST ARRESTING EQUIPMENT

American Air Filter Co., Inc., 266 Central Ave., Louisville 8, Ky.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.
Dracco Corp., 4063 East 116th St., Cleveland 5, Ohio.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Pangborn Corp., Hagerstown, Md.

DUST ARRESTING EQUIPMENT (Cont'd.)

Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

DUST COLLECTORS

Pangborn Corp., Hagerstown, Md.
Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

DUST COLLECTORS (Shake-out)

Pangborn Corp., Hagerstown, Md.

DUST CONTROL (Chemical)

Dracco Corp., 4063 East 116th St., Cleveland 5, Ohio.
Pangborn Corp., Hagerstown, Md.
Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

DUST RECOVERY SYSTEMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Dracco Corp., 4063 East 116th St., Cleveland 5, Ohio.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Pangborn Corp., Hagerstown, Md.

DYES & CHEMICALS

Eaton Chemical & Dyestuff Co., 1490 Franklin, Detroit, Mich.

ELECTRIC FURNACES (see Furnaces, Electric)

ELECTRODES (Graphite and Amorphous)

International Graphite & Electrode Corp., St. Marys, Pa.
National Carbon Co., Inc., Electrode Sales Div., 30 E. 42nd St., New York 17, N. Y.

ELEVATORS

Standard Conveyor Co., North St. Paul 9, Minn.

ELEVATORS (Bucket)

Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Jeffrey Mfg. Co., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.

ELEVATORS (Material Handling)

Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

ELEVATORS (Pneumatic, Material Handling)

Fuller Co., Catasauqua, Pa.

ENGINEERING SERVICE (Foundry)

H. K. Ferguson, 1783 E. 11th St., Cleveland 14, Ohio.
Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.

ENGINEERING SERVICE (Foundry) (Cont'd.)

Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.
A. H. Putnam Co., 1319 2nd Ave., Rock Island, Ill.
Westover Engineers, 424 E. Wells St., Milwaukee 2, Wis.

EXHAUST SYSTEMS

American Air Filter Co., Inc., Louisville 8, Ky.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corporation, Hagerstown, Md.
Schneible Co., Claude B., 2827 25th St., Detroit 16, Mich.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

FABRICATORS (Metal)

Roura Iron Works, 1405 Woodland Ave., Detroit 11, Mich.

FACINGS

Delta Oil Products Co., Milwaukee 9, Wis.
Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Stevens Inc., Frederic B., Detroit 16, Mich.
Titanium Alloy Mfg. Div., Hyde Park Blvd., Niagara Falls, N. Y.
United States Graphite Co., Saginaw, Mich.

FANS (Ventilating, Exhaust, Cooling, etc.)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Hartzell Propeller Fan Co., Piqua, Ohio
Joy Mfg. Co., La Del Division, New Philadelphia, Ohio.
Pangborn Corp., Hagerstown, Md.

FEEDERS (Rotary)

Fuller Company, Catasauqua, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Newaygo Engineering Co., Newaygo, Mich.

FEEDERS (Sand)

Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

FERROBORON

Electro Metallurgical Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Molybdenum Corp. of America, Pittsburgh 19, Pa.

FERROCHROME

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St. New York 17, N. Y.
Hickman-Williams & Co., Cleveland, O.
Ohio Ferro-Alloys Corp., Canton 2, O.
Vanadium Corp., of America, 420 Lexington Ave., New York, N. Y.

FERROCOLUMBIUM

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

FERROMANGANESE

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Ohio Ferro-Alloys Corp., Canton 2, O.
Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.

FERROMOLYBDENUM

Climax Molybdenum Co., 500 Fifth Ave., New York 18, N. Y.
Molybdenum Corporation of America, Pittsburgh 19, Pa.

FERROPHOSPHOROUS

Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.

FERROSILICON

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Jackson Iron & Steel Co., Jaakson, O.
Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.
Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.
Ohio Ferro-Alloys Corp., Canton 2, O.
Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.
Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FERROTITANIUM

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FERROTUNGSTEN

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Molybdenum Corp. of America, Pittsburgh 19, Pa.

FERROVANADIUM

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FILLET (Leather)

Milwaukee Leather Belting Co., 1114 No. Water St., Milwaukee, Wis.

FILM (X-Ray)

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

FILTERS (Air)

American Air Filter Co., 266 Central Ave., Louisville 8, Ky.
Dollinger Corp., 36 Centre Park, Rochester 4, N. Y.

FILTERS (Liquid)

Dollinger Corp., 36 Centre Park, Rochester 4, N. Y.

FIRE BRICK

Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.

FIRE BRICK (Cont'd.)

Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Building, Buffalo 2, N. Y.
A. P. Green Fire Brick Co., Mexico, Missouri.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.
Mexico Refractories Co., Mexico, Mo.
Norton Co., Worcester 6, Mass.
Stevens Inc., Frederic B., Detroit 16, Mich.
Chas. Taylor Sons Co., P.O. Box 58, Annex Sta., Cincinnati 14, Ohio.

FIRE CLAY

Eastern Clay Products, Inc., Jackson, O.
A. P. Green Fire Brick Co., Mexico, Missouri.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.
Ironton Fire Brick Co., Ironton, O.
Chas. Taylor Sons Co., P.O. Box 58, Annex Sta., Cincinnati 14, O.

FIRE SAND

Carborundum Co., Niagara Falls, N. Y.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FIRESTONE

Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FLASK BANDS

Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

FLASK BUSHINGS

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Universal Engineering Co., Frankenmuth, Mich.

FLASK PINS

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Universal Engineering Co., Frankenmuth, Mich.

FLASKS (Aluminum)

Adams Co., Dubuque, Iowa.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASKS (Dowmetal)

Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASK FILLERS

Bartlett & Snow, C., C., Co., 6201 Harvard Ave., Cleveland 5, O.

FLASK FILLERS (Cont'd.)

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., Columbus 16, O.

FLASKS (Slip)

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

FLASKS (Snap)

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Stevens, Inc., Frederic B., Detroit 16, Mich.

FLASKS (Steel)

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

FLASK FITTINGS

Adams Co., Dubuque, Iowa.
Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Diamond Clamp & Flask Co., Richmond, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

FLASK LIFT MACHINES

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

FLASK LUMBER

Dougherty Lumber Co., 4300 E. 66th St., Cleveland 5, O.

FLASKS (Wood)

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.

FLOORING (Non-Slip)

Norton Co., Worcester 6, Mass.

FLUXES

American-British Chemical Supplies Inc., 180 Madison Ave., New York 16, N. Y.
Apex Smelting Co., 2537 West Taylor St., Chicago 12, Ill.
Atlantic Chemical & Metals Co., 1925 N. Kenmore, Chicago 14, Ill.
Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Mathieson Chemical Corp., Mathieson Bldg., Baltimore 3, Md.

FLUXES (Cont'd.)

Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
Puro-Seal Co., 2323 West Third, Cleveland 13, Ohio.

FLUXES (Soldering, Welding & Tinning)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

FOUNDRY CONSULTANTS

Lester B. Knight & Associates Inc., 600 West Jackson Blvd., Chicago 3, Ill.

FOUNDRY ENGINEERS

Edwin S. Carman, 1643 Lee Road, Cleveland 18, Ohio.
Lester B. Knight & Associates Inc., 600 West Jackson Blvd., Chicago 3, Ill.
A. A. Wickland Co., 205 W. Wacker Dr., Chicago 6, Ill.

FOUNDRY LAYOUT & METHODS

H. K. Ferguson, 1783 E. 11th St., Cleveland 14, Ohio.
Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.
Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

FOUNDRY NAILS

Capewell Mfg. Co., Hartford, Conn.
Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.
Standard Horse Nail Corp., New Brighton, Pa.

FOUNDRY SHOVELS

(See SHOVELS)

FOUNDRY SUPPLY HOUSES

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7, N. Y.
Eastern Clay Products, Inc., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundries Materials Co., Coldwater, Mich.
Stevens, Inc., Frederic B., Detroit 16, Mich.

FURNACES (Aluminum & Magnesium Billets)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

FURNACES (Aluminum & Magnesium Forgings)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

FURNACES (Aluminum Melting)

Ajax Engineering Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.

FURNACES (Aluminum Rivet Heating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.

FURNACES (Annealing)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

FURNACES (Crucible Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Campbell-Hausfeld Co., 300-320 Moore St., Harrison, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

FURNACES (Electric Melting)

Ajax Electric Furnace Corp., 46 Richmond St., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Greene Electric Furnace Co., 2702 6th So., Seattle 4, Wash.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Gas or Oil Fired)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Company, 750 Prospect Ave., Cleveland 15, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

FURNACES (Gray Iron Melting)

American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.

FURNACES (Heat Treating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

FURNACES, HEAT TREATING (Electric)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Trenton, N. J.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

FURNACES (Induction Heating)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

FURNACES (Malleable Annealing)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
General Electric Co., Schenectady, N. Y.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Malleable Melting)

American Bridge Co., Pittsburgh 19, Pa.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Nonferrous Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

FURNACES (Powdered Coal)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Steel Melting)

Ajax Electrothermic Corp., Trenton, N. J.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.

FURNACE BLOWERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.

FURNACE LININGS

Campbell-Hausfeld Co., Harrison, O.
Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Building, Buffalo 2, N. Y.
A. P. Green Fire Brick Co., Mexico, Missouri.
Ironton Fire Brick Co., Ironton, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.
United States Graphite Co., Saginaw, Mich.

GAGGERS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Wadsworth Equipment Co., 560 Lafollette St., Akron, Ohio.

GAS (Oxygen, Acetylene, Industrial)

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

GAS BURNERS

Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard St., Chicago 12, Ill.

GENERATORS (Acetylene)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

GLOVES (Industrial, Safety)

American Optical Co., Southbridge, Mass.
United States Rubber Co., 4300 New Haven Ave., Ft. Wayne 4, Ind.

GOGGLES and EYE PROTECTORS

American Optical Co., Southbridge, Mass.
Chicago Eye Shield Co., 2300 West Warren, Chicago 12, Ill.
B. F. McDonald Co., 5112 South Hoover St., Los Angeles 37, Calif.
Wilson Products Inc., Reading, Pa.

GRAPHITE

Asbury Graphite Mills, Asbury, N.J.
Acheson Colloids Corp., Port Huron, Mich.
Bloomsbury Graphite Co., Bloomsbury, N. J.
Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
International Graphite & Electrode Corp., St. Marys, Pa.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17.
United States Graphite Co., Saginaw, Mich.

GRAPHITIZER

United States Graphite Co., Saginaw, Mich.

GRINDERS (Electric Portable)

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Independent Pneumatic Tool Co., Aurora, Ill.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
U. S. Electrical Tool Co., Cincinnati 4, O.

GRINDERS (Hand)

Chicago Wheel & Mfg. Co., 1101 W. Monroe, Chicago 7, Ill.

GRINDERS (Pneumatic Portable)

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Tex.
Independent Pneumatic Tool Co., Aurora, Ill.

GRINDERS (Pneumatic Portable) (Cont'd.)

Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.

GRINDERS (Surface, Bench, Disc, Floor)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Independent Pneumatic Tool Co., Aurora, Ill.
U. S. Electrical Tool Co., 2488 River Rd., Cincinnati 4, O.
Vonnegut Moulder Corp., 1815 Madison Ave., Indianapolis 2, Ind.

GRINDERS (Swing Frame)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Sutter Products Co., Dearborn, Mich.
Vonnegut Moulder Corp., 1815 Madison Ave., Indianapolis 2, Ind.

GRINDING WHEELS—See ABRASIVE WHEELS

GRINDING WHEEL DRESSERS

Carborundum Co., Niagara Falls, N. Y.
Desmond-Stephans Mfg. Co., Urbana, O.

GRINDSTONES

Bay State Abrasive Products Co., Westboro, Mass.

GRIT (Abrasive)

Alloy Metal Abrasive Co., Ann Arbor, Mich.
American Steel Abrasives Co., Galion, O.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Carborundum Co., Niagara Falls, N. Y.
Clayton Sherman Abrasives Co., 3896 Lonyo Rd., Detroit 10, Mich.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Globe Steel Abrasive Co., Mansfield, Ohio.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.

HAMMERS (Chipping)

Arrow Tools Inc., 1900 S. Kostner, Chicago, Ill.
Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, Ohio.
Independent Pneumatic Tool Co., Aurora, Ill.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Schramm Inc., West Chester, Pa.

HARDNESS TESTING EQUIPMENT

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
Steel City Testing Machines Inc., 8843 Livernois Ave., Detroit 4, Mich.
Foxboro Company, Foxboro, Mass.
Claude S. Gordon Co., 3000 So. Wallace, Chicago 16, Ill.
Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.

HEAT CONTROL AND RECORDING DEVICES (Cont'd.)

Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.

HEATERS (Gas, Oil, Electric)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

HEATERS (High Frequency Electric)

Ajax Electrothermic Corp., Trenton, N. J.

HEATERS (Indirect Fired)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

HEATERS (Space, Unit, Direct Fired)

Dravo Corp., Neville Island, Pittsburgh 25, Pa.
Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.

HEATERS (Space, Unit, Oven, Water)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

HELMETS (Blasting)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Optical Co., Southbridge, Mass.
B. F. McDonald Co., 5112 South Hoover St., Los Angeles 37, Calif.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

HELMETS (Welding)

American Optical Co., Southbridge, Mass.

HOISTS (Air)

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Curtis Pneumatic Machinery Div. Curtis Mfg. Co., 1943 Kienlen Ave., St. Louis 20, Mo.
Gardner-Denver Co., Quincy, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.

HOISTS (Chain)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.

HOISTS (Electric)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

HOISTS (Hand)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.

HOISTS (Hydraulic)

Miller Motor Co., 4027 N. Kedzie, Chicago 18, Ill.

HOODS (Shakeout, pouring)

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

HOPPERS (Sand)

Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

HOSE (Air, Blasting, Water, Gas)

Boston Woven Hose & Rubber Co., 29 Hampshire, Cambridge 39, Mass.
Gardner-Denver Co., Quincy, Ill.
Hewitt Rubber Div. Hewitt-Robins Div., Inc., 240 Kinsington Ave., Buffalo 5, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Pangborn Corp., Hagerstown, Md.
Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J.
Schramm Inc., West Chester, Pa.

HOSE FITTINGS

Boston Woven Hose & Rubber Co., 29 Hampshire, Cambridge 39, Mass.

HYDRAULIC CLEANING EQUIPMENT

Pangborn Corp., Hagerstown, Md.

HYDRO FINISHING EQUIPMENT

Pangborn Corp., Hagerstown, Md.

ILLUMINATORS (X-Ray Films)

Eastman Kodak Co., Rochester, N. Y.

IMPREGNATING SYSTEMS

Empire Varnish Co., 2636 E. 76th St., Cleveland 4, O.
Tincher Products Co., Sycamore 12, Ill.

INDUSTRIAL ENGINEERING SERVICE

Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

INGOT MOLDS

Acme Foundry Co., Detroit 16, Mich.

INGOTS (Nonferrous)

Federated Metals Div. of American Smelting and Refining Co., 120 Broadway, New York 5.
Apex Smelting Co., 2537 West Taylor St., Chicago 12, Ill.
Federated Metals Div., American Smelting and Ref. Co., New York 5.
Frontier Bronze Corp., 818 Elmwood Ave., Niagara Falls, N. Y.
International Nickel Co., Inc., 67 Wall St., New York City 5.
R. Lavin & Sons Inc., 3426 So. Kedzie Ave., Chicago 23, Ill.
Northwestern Iron & Metal Co., 900 "T" Street, Lincoln, Nebraska.
Sonken-Galamba Corp., Kansas City 18, Kansas.
Western Metals Co., 3201 So. Kedzie Ave., Chicago 23, Ill.

INJECTION MOLDING MACHINES

Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.

INOCULANTS

Carborundum Co., Perth Amboy, N. J.
United States Graphite Co., Saginaw, Mich.

IRON CEMENT

Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City 4, N. J.

IRON ORE

Pickands, Mather & Co., Cleveland 14, O.

IRON OXIDES

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.
Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

JACKETS (Mold)

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

LABORATORY EQUIPMENT (Chemical)

Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.

LABORATORY EQUIPMENT (Physical)

Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
E. Leitz Inc., 730 Fifth Ave., New York 19, N. Y.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Norton Co., Worcester 6, Mass.

LADLES

Industrial Equipment Co., Minster, O.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Modern Equipment Co., Port Washington, Wis.
Frederic B. Stevens, Inc., Detroit 16, Mich.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

LADLE LININGS

A. P. Green Fire Brick Co., Mexico, Missouri.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Ironton Fire Brick Co., Ironton, Ohio.
United States Graphite Co., Saginaw, Mich.

LEAD

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5.

LIFT TRUCKS

Clark Industrial Truck Div. Clark Equipment Co., Battle Creek, Mich.
Frank G. Hough Co., Libertyville, Ill.
Towmotor Corp., 1226 East 152nd St., Cleveland 10, Ohio

LINSEED OIL

Hercules Powder Co., Wilmington 99, Del.

LOADERS

Clearfield Machine Co., Clearfield, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

LOADERS (Tractor-Mounted)

Frank G. Hough Co., Libertyville, Ill.

LUBRICANTS (Industrial)

Acheson Colloids Corp., Port Huron, Mich.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
United States Graphite Co., Saginaw, Mich.

MACHINE KEYS

Standard Horse Nail Corp., New Brighton, Pa.

MAGNESIUM (Ingots)

Apex Smelting Co., 2537 West Taylor St., Chicago 12, Ill.
Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

MAGNET CONTROLLERS

Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.

MAGNETS

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

MANGANESE (Briquets)

Electro Metallurgical Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

MATCH PLATE METAL

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

MATCHPLATES

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.
Central Pattern Co., Quincy, Ill.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Plaster Process Castings Co., 6922 Carnegie Ave., Cleveland 3, O.
Scientific Cast Products Corp., 1388-92 E. 40th St., Cleveland 3, O.

MATERIALS HANDLING EQUIPT.

Frank G. Hough Co., Libertyville, Ill.

MATERIALS HANDLING (Hoists)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

MECHANICAL ENGINEERS

Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.

MELTING POTS

Acme Foundry Co., Detroit 16, Mich.

METAL CLEANING EQUIPMENT

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

METALLOGRAPHIC EQUIPMENT

Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

METALLURGISTS

Crobaugh Co., Frank L., 1426 West Third St., Cleveland 13, Ohio.

METERS (Gas, Air, Water)

Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.

MIXERS (Core Wash)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Multiplex Machinery Corp., Elmore, Ohio.

MIXERS (Sand and Clay)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Clearfield Machine Co., Clearfield, Pa.
Construction Machinery Co., Waterloo, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, Ohio.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Multiplex Machinery Corp., Elmore, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Posey Iron Works, Inc., Lancaster, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

MOLD CONVEYORS

Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.

MOLD COOLING HOODS

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

MOLD DRYERS

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

MOLD OVENS and DRYERS

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.

MOLD OVENS and DRYERS (Cont'd.)

Despatch Oven Co., Minneapolis 14, Minn.
Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, O.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.

MOLD TRUCKS (Power Operated)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.

MOLD WASH

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.
United States Graphite Co., Saginaw, Mich.

MOLDING MACHINES

Adams Co., Dubuque, Iowa.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Berkshire Mfg. Co., 1111 Power Ave., Cleveland 14, Ohio.
British Moulding Machine Co., Faverham, Kent, England.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Johnston & Jennings Div., Pettibone-Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.
Milwaukee Foundry Equipment Div. Spo Inc., 3238 W. Pierce St., Milwaukee 4, Wis.
Moline Iron Works, Moline, Ill.
Nichols, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Jolt)

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1553 West Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Johnston & Jennings Div., Pettibone-Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Nichols, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Rollover)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.

MOLDING MACHINES (Rollover) (Cont'd.)

Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Johnston & Jennings Div., Pettibone-Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Sutter Products Co., Dearborn, Mich.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Squeeze)

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Johnston & Jennings Div., Pettibone-Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Moline Iron Works, Moline, Ill.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING SANDS

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Foundries Materials Co., Coldwater, Mich.
Ottawa Silica Co., Ottawa, Ill.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

MOLYBDENUM

Molybdenum Corporation of America, Pittsburgh 19, Pa.

MONOGRAMS & TRADE MARKS

H. P. Maughlin Co., 953 Ingleside Ave., Columbus, Ohio.

MONORAIL SYSTEMS

American Monorail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Modern Equipment Co., Port Washington, Wis.

MOTORS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.

MULLERS (Portable)

Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.

NAILS (Chill)

Angell Nail & Chaplet Co., 4580 E. 71st St., Cleveland 5, O.
Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.
Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.
Standard Horse Nail Corp., New Brighton, Pa.

NICKEL

International Nickel Co., Inc., 67 Wall St., New York City 5.

NITROGEN

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

NOZZLES (Blasting)

Alloy Metal Abrasives Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Davenport Machine & Foundry Co., Davenport, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Norton Co., Worcester 6, Mass.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

OIL BURNERS

Hauck Manufacturing Co., 106 Tenth St., Brooklyn 15, N. Y.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

OVENS (Annealing and Heat Treating)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Lindberg Engineering Co., Fisher Furnaces Div., 2450 West Hubbard, Chicago 12, Ill.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

OVENS (Core) (See CORE OVENS)

OVENS (Enameling, Japanning)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

OVENS (Mold)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

OXYGEN

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

PAINTS (Graphite)

Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.

PARTING COMPOUNDS

Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.

PARTING COMPOUNDS (Cont'd.)

Frederic B. Stevens, Inc., Detroit 16, Mich.

Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PATTERN COATINGS

American Lacquer Solvents Co., Phoenixville, Pa.

PATTERN COMPOUND

Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PATTERN LETTERS

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.

H. P. Maughlin Co., 953 Ingleside Ave., Columbus, Ohio.

PATTERN LUMBER

Dougherty Lumber Co., Cleveland 5, O.

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.

PATTERN METAL

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

Niagara Falls Smelting & Refining Div., Continental-United Industries Co. Inc., 2204 Elmwood Ave., Buffalo 17, New York.

PATTERN PLATES

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.

Buffalo Pattern Works, 830 Hertel Ave., Buffalo, N. Y.

Central Pattern Co., Quincy, Ill.

City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

Plaster Process Castings Co., 6922 Carnegie Ave., Cleveland 3.

Scientific Cast Products Corp., 1388-92 E. 40th St., Cleveland 3, O.

PATTERN SHOP EQUIPMENT

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.

Milwaukee Leather Belting Co., 1114 No. Water St., Milwaukee, Wis.

Oliver Machinery Company, Grand Rapids 2, Mich.

PATTERNS (Plastic)

Central Pattern Co., Quincy, Ill.

PATTERNS (Wood, Metal)

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.

Buffalo Pattern Works, 830 Hertel Ave., Buffalo, N. Y.

Central Pattern Co., Quincy, Ill.

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.

City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.

Wellman Bronze & Aluminum Co., 2525 E. 93rd St., Cleveland 4, O.

PERMANENT MOLDS

Centrifugal Casting Machine Co., Tulsa, Okla.

Reserve Machine & Tool Co., 10026 Detroit Ave., Cleveland, Ohio.

PHOSPHOR COPPER

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

Niagara Falls Smelting & Refining Div. Continental-United Industries Co. Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

PHOTOGRAPHIC EQUIPMENT

Eastman Kodak Co., Rochester, N. Y.

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

PHOTOGRAPHY (Industrial)

Eastman Kodak Co., Rochester, N. Y.

PIG IRON

Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.

Jackson Iron & Steel Co., Jackson, Ohio.

Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.

Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.

Pickands, Mather & Co., Cleveland 14, O.

Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.

Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.

Woodward Iron Co., Woodward, Ala.

PIG IRON (Silvery)

Jackson Iron & Steel Co., Jackson, O.

Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.

Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.

PINS (Flask)

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

Shanafelt Mfg. Co., 3623 Winfield Way, N.E., Canton 5, Ohio.

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

Universal Engineering Co., Frankenmuth, Mich.

PISTON RINGS (for Molding Machines, Compressors, etc.)

Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.

PLANT ENGINEERING SERVICE

H. K. Ferguson, 1783 E. 11th St., Cleveland 14, Ohio.

Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.

Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

PLATES (Bottom)

Adams Co., Dubuque, Iowa.

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

PLATES (Core Drying)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.

Johns-Manville, 22 East 40th St., New York 16.

PLATING TEMPERATURE CONTROLS

Foxboro Company, Foxboro, Mass.

PLUMBAGO

Bloomsbury Graphite Co., Bloomsbury, N. J.

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

Frederic B. Stevens, Inc., Detroit 16, Mich.

United States Graphite Co., Saginaw, Mich.

PNEUMATIC TOOLS

Arrow Tools Inc., 1900 S. Kostner, Chicago, Ill.

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.

Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.

Dayton Pneumatic Tool Co., Dayton 1, Ohio.

Gardner-Denver Co., Quincy, Ill.

Independent Pneumatic Tool Co., Aurora, Ill.

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

Joy Mfg. Co., Sullivan Division, Michigan City, Ind.

Master Pneumatic Tool Co., Inc., Orwell, Ohio.

Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.

Schramm Inc., West Chester, Pa.

POURING DEVICES

Industrial Equipment Co., Minster, Ohio.

Modern Equipment Co., Port Washington, Wis.

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

PRESSER BOARDS

Adams Co., Dubuque, Iowa.

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

PRESSURE CASTING SEALER

Empire Varnish Co., 2636 E. 76th St., Cleveland 4, O.

Tincher Products Co., Sycamore 12, Ill.

PRESSURE RECORDERS

Foxboro Company, Foxboro, Mass.

PROTECTIVE MATERIALS (X-Ray)

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

PULLEYS (Magnetic)

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.

Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

PUMPS

Construction Machinery Co., Waterloo, Iowa.

Gardner-Denver Co., Quincy, Ill.

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

PUMPS (Dry, Vacuum)

Allis Chalmers Mfg. Co., Milwaukee 1, Wis.

Fuller Company, Catasauqua, Pa.

Roots-Connersville Blower Corp., Connersville, Ind.

PURIFIERS

Cleveland Flux Co., 1026 Main St., Cleveland 13, O.

PUSH-OFF MACHINES

Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.

International Molding Machine Co., LaGrange Park, Ill.

Milwaukee Foundry Equipment Div. Spo Inc., 3238 W. Pierce St., Milwaukee 4, Wis.

PUTTY (Foundry)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

PYROMETERS

Foxboro Company, Foxboro, Mass.

Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.

Claude S. Gordon Co., 3000 So. Wallace, Chicago 16, Ill.

Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.

Marshall Co., L. H., 270 W. Lane, Columbus 1, O.

Pyrometer Instrument Co., Bergenfield, N. J.

Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PYROMETERS (Immersion)

Pyrometer Instrument Co., Bergenfield, N. J.

PYROMETERS (Optical)

Pyrometer Instrument Co., Bergenfield, N. J.

RACKS (Core Ovens)

Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

RADIOGRAPHY (Industrial)

Eastman Kodak Co., Rochester, N. Y.

Eldorado Mining & Refining Ltd., P.O. Box 379, Ottawa, Ont.

Radium Chemical Co., Inc., 570 Lexington Ave., New York 22, N. Y.

RADIUM

Eldorado Mining & Refining Ltd., P.O. Box 379, Ottawa, Ont.

Radium Chemical Co., Inc., 570 Lexington Ave., New York 22, N. Y.

REFRACTORIES

Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.

Carborundum Co., Niagara Falls, N. Y.

Carborundum Co., Perth Amboy, N. J.

Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.

Eastern Clay Products, Inc., Jackson, O.

Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.

A. P. Green Fire Brick Co., Mexico, Missouri.

Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.

Ironton Fire Brick Co., Ironton, O.

Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

Mexico Refractories Co., Mexico, Mo.

REFRACTORIES (Cont'd.)

Norton Co., Worcester 6, Mass.
Richard C. Remmey Son Co., Hedley St. & Delaware River, Philadelphia 37, Pa.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.
Chas. Taylor Sons Co., P.O. Box 58, Annex Sta., Cincinnati 14, Ohio.
United States Graphite Co., Saginaw, Mich.

RESPIRATORS

Wilson Products Inc., Reading, Pa.

RIDDLES

Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

RIDDLES (Electric)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Great Western Mfg. Co., Leavenworth, Kans.

RIDDLES (Hand)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

ROD DIP

Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.

ROD STRAIGHTENERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

RODS (Steel)

Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.

ROLLER-HEARTH FURNACES (Electric Annealing)

General Electric Co., Schenectady, N. Y.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.

RUBBER LINING MATERIAL

(Abrasive Resisting)
Pangborn Corp., Hagerstown, Md.

SAFETY CLOTHING

American Optical Co., Southbridge, Mass.
B. F. McDonald Co., 5112 South Hoover St., Los Angeles 37, Calif.
Pangborn Corp., Hagerstown, Md.

SAND ARRESTER TUBES

Martin Engineering Co., Kewanee, Ill.

SAND (Core, Molding, Blasting)

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Carpenter Brothers, Inc., 606 West Wisconsin, Milwaukee 3, Wis.
Ottawa Silica Co., Ottawa, Ill.
Pangborn Corp., Hagerstown, Md.
Producers Core Sand Corp., Michigan City, Ind.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

SAND BLAST BARRELS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST CABINETS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

SAND BLAST EQUIPMENT

American Air Filter Co., 266 Central Ave., Louisville 8, Ky.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

SAND BLAST NOZZLES

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Norton Company, Worcester 6, Mass.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST ROOMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST TABLES

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST CONDITIONERS

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.

SAND CONTROL & TESTING EQUIPMENT

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND CONVEYING and HANDLING EQUIPMENT

American Air Filter Co., Louisville 8, Ky.
Ajax Flexible Coupling Co., Westfield, N. Y.
C. O. Bartlett & Snow Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Clearfield Machine Co., Clearfield, Pa.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.

SAND CONVEYING and HANDLING EQUIPMENT (Cont'd.)

Frank G. Hough Co., Libertyville, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Penn Iron Works, Reading, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

SAND CONVEYING and HANDLING EQUIPMENT (Pneumatic)

Fuller Company, Catasauqua, Pa.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.

SAND COOLING SYSTEMS

Newaygo Engineering Co., Newaygo, Mich.

SAND DRYERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, Ohio.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.

SANDERS (Pneumatic)

Cleco Division of Reed Roller Bit Co., Houston, Texas.

SANDING MACHINERY (Disc, Spindle, Belt, etc.)

Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Oliver Machinery Company, Grand Rapids 2, Mich.

SAND MEASURING and WEIGHING DEVICES

Baker Perkins Inc., Saginaw, Mich.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND MIXERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.
Clearfield Machine Co., Clearfield, Pa.
Construction Machinery Corp., Waterloo, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, Ohio.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Multiplex Machinery Corp., Elmore, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.

SAND PREPARATION EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Ajax Flexible Coupling Co., Westfield, N. Y.

SAND PREPARATION EQUIPMENT (Cont'd.)

Baker Perkins Inc., Saginaw, Mich.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.
Clearfield Machine Co., Clearfield, Pa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, Ohio.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Moulders Friend, Dallas City, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Royer Foundry & Machine Co., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

SAND RAMMERS

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.

SAND RECLAIMERS

Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

SAND SIFTING and SCREENING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Air Filter Co., Louisville 8, Ky.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, Ohio.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Great Western Mfg. Co., Leavenworth, Kansas.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.
Pangborn Corp., Hagerstown, Md.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

SAND STORAGE BINS & GATES

Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, Ohio.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Neff & Fry Co., Camden, O.

SAWS (Band, Metal, Wood)

Atlantic Saw Mfg. Co., New Haven, Conn.
Oliver Machinery Company, Grand Rapids 2, Mich.

SAWS (Cold Metal)

Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

SCALING HAMMERS

Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Schramm, Inc., West Chester, Pa.

SCREENS (Shake-Out)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Barlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, Ohio.
Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Simplicity Engineering Co., Durand, Mich.

SCREENS (Vibrating)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Ajax Flexible Coupling Co., Westfield, N. Y.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Simplicity Engineering Co., Durand, Mich.

SEA COAL

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.

SEPARATORS (Abrasive)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

SEPARATORS (Air, Moisture, Oil)

American Air Filter Co., Louisville 8, Ky.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Dollinger Corp., 36 Centre Park, Rochester 4, N. Y.
Jas. A. Murphy & Co., Hamilton, O.
Pangborn Corp., Hagerstown, Md.

SEPARATORS (Magnetic)

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

SHAKE-OUT MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Air Filter Co., Louisville 8, Ky.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
New Haven Vibrator Co., 131 Chesnut St., New Haven 7, Conn.

SHAKE-OUT MACHINERY (Cont'd.)

Robins Conveyors, Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Royer Foundry & Machine Co., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

SHOT AND GRIT

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Steel Abrasives Co., Galion, O.
Carpenter Brothers, Inc., 606 West Wisconsin, Milwaukee 3, Wis.
Clayton Sherman Abrasives Co., 3896 Lonyo Rd., Detroit 10, Mich.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Eaton Metal Abrasive Corp., 110 N. Elizabeth St., Eaton Rapids, Mich.
Globe Steel Abrasive Co., Mansfield, O.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Steel Shot & Grit Co., Inc., 39 Warren Ave., Boston, Mass.

SHOT (Peening)

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Steel Abrasive Co., Galion, O.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Globe Steel Abrasive Co., Mansfield, Ohio.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.
Steel Shot & Grit Co., Inc., 39 Warren Ave., Boston, Mass.

SHOVELS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.

SHOVELS (Power)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Frank G. Hough Co., Libertyville, Ill.

SILICA FLOUR

Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, O.
Ottawa Silica Co., Ottawa, Ill.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

SILICOMANGANESE

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

SILICON (Briquets)

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Ohio Ferro-Alloys Corp., Canton 2, Ohio.

SILICON CARBIDE (Briquets)

Carborundum Co., Perth Amboy, N. J.

SILVERY PIG IRON see Pig Iron (Silvery)

SKIMMERS

Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

SKIP HOISTS

Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Gardner-Denver Co., Quincy, Ill.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Whiting Corporation, 1560 Lathrop Ave., Harvey, Ill.

SLIP FLASKS

Adams Co., Dubuque, Iowa.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

SLINGS (Chain)

Jeffrey Mfg. Co., Columbus 16, O.

SLIP JACKETS

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

SMELTERS & REFINERS

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5.
R. Lavin & Sons Inc., 3426 So. Kedzie Ave., Chicago 23, Ill.

SNAGGING WHEELS—See ABRASIVE WHEELS

SNAP FLASKS

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

SODA ASH

Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
Hercules Powder Co., Wilmington 99, Del.
Mathieson Chemical Corp., Mathieson Bldg., Baltimore 3, Md.
Solvay Sales Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

SOLDER

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5.

SPACE HEATERS

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

SPECIAL FOUNDRY ALLOYS

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.
Niagara Falls Smelting & Refining Div. Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

SPRAY GUNS

Murphy & Co., Jas. A., Hamilton, O.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.

SPRUE CUTTERS

Adams Co., Dubuque, Iowa.
Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Milwaukee Chaplet & Mfg. Co., 1023 S. 40th St., Milwaukee, Wis.
Rice Pump & Machine Co., 1026 S. 40th St., Milwaukee 15, Wis.

STACKING BOXES

Palmer-Shile Co., 1600 Fullerton Ave., Detroit 27, Mich.

STEEL SHOT

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Steel Shot Producers, Inc. Butler, Pa.

STEEL (Structural)

American Bridge Co., Pittsburgh 19, Pa.

STOPPERS (Graphite)

Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.

STRAINER CORES

Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.

STRIPPING MACHINES

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Devenport Machine & Foundry Co., Davenport, Iowa.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3238 W. Pierce St., Milwaukee 4, Wis.

SURFACE TREATMENT METALS

Pangborn Corp., Hagerstown, Md.

TANKS (Dewatering)

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

TAPE (Friction & Rubber)

Boston Woven Hose & Rubber Co., 29 Hampshire, Cambridge 39, Mass.

TAPER PINS

Standard Horse Nail Corp., New Brighton, Pa.

TELLURIUM

American Smelting & Refining Co., 120 Broadway, New York 5, N.Y.

TEMPERATURE CONTROLLERS

Foxboro Company, Foxboro, Mass.
Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.

TESTING EQUIPMENT

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Steel City Testing Machines Inc., 8843 Livernois Ave., Detroit 4, Mich.

TESTING MACHINES (Tensile)

Harry Dietert Co., 9330A Roseiawn Ave., Detroit 4, Mich.
Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Steel City Testing Machines Inc., 8843 Livernois Ave., Detroit 4, Mich.

THERMOCOUPLES

Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.
Pyrometer Instrument Co., Bergenfield, N. J.
Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

TIERING MACHINES (Power)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.

TIMERS (Electric)

Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.

TIN

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

TIRES (Band Saw)

Carter Products, Grand Rapids, Mich.

TONGS

Industrial Equipment Co., Minster, O.

TOOLS ((Pneumatic Portable)

Arrow Tools Inc., 1900 S. Kostner, Chicago, Ill.
Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Dayton Pneumatic Tool Co., Dayton 1, O.
Gardner-Denver Co., Quincy, Ill.
Independent Pneumatic Tool Co., Aurora, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Schramm Inc., West Chester, Pa.

TORCHES and BURNERS (Acetylene, gas, Oil)

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Hauck Mfg. Co., 106 Tenth St., Brooklyn 15, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17.

TOTE BOXES (see "BOXES-TOTE")

TRACTOR (Gas Powered)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Frank G. Hough Co., Libertyville, Ill.

TRADE ASSOCIATIONS

Crucible Manufacturers Association, 90 West St., New York 6, N. Y.

TRAMRAIL SYSTEMS

American MonoRail Co., 13104 Athens Ave., Cleveland 7, Ohio
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Modern Equipment Co., Port Washington, Wis.

TRAPS

Jas. A. Murphy & Co., Hamilton, Ohio.

TROLLEYS

Curtis Pneumatic Machinery Div. Curtis Mfg. Co., 1943 Kienlen Ave., St. Louis 20, Mo.
Modern Equipment Co., Port Washington, Wis.

TRUCK CRANES

Silent Hoist & Crane Co., 885 63rd St., Brooklyn 20, N. Y.

TRUCK WHEELS

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

TRUCKS (Casting)

Kwix-Mix Co., Port Washington, Wis.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

TRUCKS (Core)

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

TRUCKS (Core Oven)

Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

TRUCKS (Power Lift)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Frank G. Hough Co., Libertyville, Ill.
Towmotor Corp., 1226 East 152nd St., Cleveland 10, Ohio

TUBES (Annealing)

Pressed Steel Co., Wilkes-Barre, Pa.

TUBES (X-Ray)

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

TUMBLING BARRELS

Roversford Foundry & Machine Co., Royersford, Pa.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

TURNTABLES

Beardsley & Piper Co., The. 2424 No. Cicero, Chicago 39, Ill.
Modern Equipment Co., Port Washington, Wis.
Newaygo Engineering Co., Newaygo, Mich.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

UNIT HEATERS

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

VALVES (Air, Water, Steam)

Air-Way Pump & Equipment Co., 1050 N. Kilbourn, Chicago, Ill.

VALVES (Blow-off and Cut-off)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Wm. H. Nichols Co., Richmond Mill, Long Island 18, N. Y.

VALVES (Oxygen, Acetylene)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

VENTILATING SYSTEMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Hartzell Propeller Fan Co., Piqua, Ohio

VENTILATING SYSTEMS (Cont'd.)

Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Pangborn Corp., Hagerstown, Md.
Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Westinghouse Electric Corp., B. F. Sturtevant Div., 40 Wall St., New York 4, N. Y.

VENTS (Core Box)

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Demmler & Bros., Wm., Kewanee, Ill.
C. M. Smillie & Co., 1124 Woodward Hgts. Blvd., Ferndale 20, Mich.

VIBRATORS

Adams Co., Dubuque, Iowa.
Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Cannon Vibrator Co., 1111 Power Ave., Cleveland 14, Ohio.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Davenport Machine & Foundry Co., Davenport, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.
Nichols Co., Wm. H., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
S P O Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.
Syntron Company, Homer City, Pa.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

VIBRATORS (Core Bench)

Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Martin Engineering Co., Kewanee, Ill.

WAX (Core, Vent, Pattern)

United Compound Co., Inc., 328 South Park Ave., Buffalo 4, N. Y.

WEDGES (Foundry)

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

WELDING GAS

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

WELDING APPARATUS (Electric arc)

Air Reduction Sales Co., 60 East 42nd St., New York 17, N.Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

WELDING and CUTTING APPARATUS and SUPPLIES

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

WELDING ELECTRODES (Carbon)

National Carbon Co., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
United States Graphite Co., Saginaw, Mich.

WELDING RODS & ELECTRODES

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.
McKay Co., 1005 Liberty Ave., Pittsburgh 22, Pa.

WETTING AGENTS

Pelron Corp., 7740 West 47th St. Lyons, Illinois

WHEELBARROWS

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis

WHEELS, ABRASIVE (Cut-off)

Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Norton Company, Worcester 6, Mass.
Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.

WHEELS (Wire)

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.

WIRE BENDERS

Redford Iron & Equipment Co. 20733 Glendale Ave., Detroit 23, Mich.

WIRE BRUSHES

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.

WIRE CUTTERS

Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio
Redford Iron & Equipment Co., 20733 Glendale Ave., Detroit 23, Mich.

WIRE NAILS

Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.

WOODWORKING MACHINERY

Oliver Machinery Co., Grand Rapids 2, Mich.

X-RAY EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

X-RAY FILMS

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

ZINC

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

—When writing advertisers, please mention THE FOUNDRY—

CLASSIFIED ADVERTISING

Help Wanted

FOUNDRY FOREMAN

To supervise operation of three large jolt roll-over mold draw from pattern machines also three large jolt stripper pin lift machines, two large core blowers and one bench core blower. Must be practical molder and coremaker, understanding core assembly molds poured without flasks, able to instruct both experienced molders and coremakers and unexperienced personnel. Address: Box 291, The FOUNDRY, Cleveland 13, Ohio.

PATTERN SHOP SUPERVISOR

An experienced pattern shop supervisor is needed by a steel foundry in Northwestern Ohio. Prefer a man experienced in railroad car castings. Furnish salary and other details on application. Address: Box 254, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOREMAN

For medium size grey iron foundry light piece work castings, hand and machine work. Must be familiar with setting piece work rates. Location North Central Ohio. Give full particulars, age and salary wanted. Address: Box 290, The FOUNDRY, Cleveland 13, Ohio.

GENERAL FOUNDRY FOREMAN

Corrosion and heat resistant foundry has definite need for progressive man with thorough knowledge of foundry and core sands, rigging for production, foundry costs and melting practice. Age 35 to 45 preferred. Some metallurgical background desirable. Location Ohio. Please submit photograph with first letter. Address: Box 249, The FOUNDRY, Cleveland 13, Ohio.

ASSISTANT FOUNDRY SUPERINTENDENT

With grey iron foundry experience wanted for permanent position in mechanized foundry, producing automotive castings, located in Middle West. Excellent opportunity with large, reputable manufacturing concern. Write stating experience, qualifications and expected salary. Address: Box 265, The FOUNDRY, Cleveland 13, Ohio.

CORE ROOM FOREMAN AND ASSISTANT FOREMAN

For a jobbing malleable iron foundry located in Western Pennsylvania. Positions are now vacant. Core making ability and ability to handle men are equally essential. Excellent opportunity for competent men. Give complete information in your application. Address: Box 264, The FOUNDRY, Cleveland 13, Ohio.

FOREMAN

Wanted in gray iron foundry. Must have experience on production line. Prefer someone with soil pipe experience. Address: Allied Foundry Co. Inc., 2 Pacific Avenue, Jersey City, N. J.

SUPERINTENDENT

Experienced superintendent wanted for cast iron soil pipe plant in Rocky Mountain area. In answering send full data on employment record to: PROFESSIONAL EMPLOYMENT SERVICE, 203 MIDLAND SAVINGS BLDG., DENVER 2, COLORADO (NO FEE).

FOUNDRY SUPERVISOR

For gray iron foundry in New Jersey. 35 to 60 men. Thorough experience in cupola operation, molding, coremaking and sand conditioning. 90% captive foundry. Advise experience, availability and starting salary. Address: Box 278, The FOUNDRY, Cleveland 13, Ohio.

CORE ROOM FOREMAN

Capable of taking full charge of core room. Must have experience in blower, rollover and sand mixtures. State age, experience and salary desired. Address: Box 284, The FOUNDRY, Cleveland 13, Ohio.

Help Wanted

GRAY IRON FOUNDRY SUPERINTENDENT

Must have practical experience in molding, rigging, core work and also be able to read blue prints. Please give age, references, wages expected and if willing to work in Milwaukee, Wisconsin territory. If you're not able to meet above qualifications, please do not apply. Address: Box 281, The FOUNDRY, Cleveland 13, Ohio.

Representatives Wanted

MANUFACTURERS' REPRESENTATIVE

To sell complete line of Air Compressors and Hose Reels especially adapted to foundry use. Line backed by Nationwide Service. Liberal commissions and promotional aids.

THE WAYNE PUMP COMPANY
FORT WAYNE, INDIANA
DEPT. RPE FOR FULL PARTICULARS

WANTED—SALES REPRESENTATIVE

With laboratory or sand control experience—to represent established concern, distributing foundry material to the foundry trade. Territory to be Northern Ohio and Northern Pennsylvania. Address: Box 260, The FOUNDRY, Cleveland 13, Ohio.

REPRESENTATIVE WANTED

Long established manufacturer of premium quality metal abrasives desires sales outlet for Buffalo, Rochester and Philadelphia areas. Reply stating present coverage and background. Address: Box 286, The FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

FOUNDRYMAN—ENGINEER

Engineering graduate, age 32, with ten years' experience in highly mechanized malleable and grey iron automotive foundry operations desires to make a connection with an aggressive and progressive organization that is interested in high quality, low cost, efficient operation. Experience covers control of cost, scrap, production and metallurgy; customer contact; estimating; gating, rigging and pattern layout; and plant engineering as well as successful plant operations. Address: Box 268, The FOUNDRY, Cleveland 13, Ohio.

PLANT MANAGER OR SUPERINTENDENT

Twenty-eight years of experience in production, semi-production, mechanized production and jobbing of grey iron castings. Fourteen years of executive capacity. Training background consists of practical shop training in shop management. Recommendations and references are the best. Age 46, married and no dependents. Address: Box 250, The FOUNDRY, Cleveland 13, Ohio.

FOREMAN OR ASSISTANT SUPERINTENDENT

Twenty years in nonferrous foundry work, 10 years in supervision from assistant foreman to assistant superintendent of 30 molder foundry. Light and medium castings. Can handle men, know molding, melting cores and scrap conscious. 38 years of age. Prefer Southern Texas or Southern California but will consider other locations. Available at once. Address: Box 243, The FOUNDRY, Cleveland 13, Ohio.

GENERAL SUPERINTENDENT

Over 20 years with present employer in supervisory capacity in fully mechanized automotive foundry desires change. Age 49—31 years' experience in gray iron covers all phases of production practices on all types automotive—agricultural and furnace castings. Address: Box 272 The FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

FOUNDRY SALES REPRESENTATIVE

Mature foundryman with pattern shop background wishes to connect with foundry producing quality grey iron castings, jobbing and production N.Y.C. area. Address: Box 257, The FOUNDRY, Cleveland 13, Ohio.

ELECTRIC STEEL MELTER

Available at once. Wide experience on both acid and basic practice. Also experience on basic alloys. Can offer best references. Contact MR. J. B. BRIDGES, 1636 11TH PL SOUTH, BIRMINGHAM, ALA., TEL. 3-7411.

FOUNDRY ENGINEER OR SUPERINTENDENT

Graduate. Experienced in production of quality castings and all phases of grey iron foundry operation. Know cupola operation, alloying and metallurgy, green and dry sand practice, core and molding sand control, solve scrap problems. Now employed in supervisory capacity in large jobbing shop. Excellent references. Address: Box 274, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Mechanical engineer with 20 years' experience as top executive in machine shops and foundries is available for responsible position. During past war years served as supervisor of captive and noncaptive foundries producing large quantities of high quality castings. Willing to do some traveling if necessary. Have an unusual combination of technical and practical experience. Address: Box 275, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY PATTERN & CASTING ENGINEER

Ten years' experience. 30 years old. Industrial engineer graduate. Will consider employment anywhere. Address: Box 266, The FOUNDRY, Cleveland 13, Ohio.

MANUFACTURER'S REPRESENTATIVE

Energetic salesman searching for an industrial line that needs representation in Oregon and Washington. Line must be of service to its customers and have a good commission rate. Address: Box 263, The FOUNDRY, Cleveland 13, Ohio.

MELTER

Desires position on acid or basic open hearth furnace. Fourteen years' experience as melter and first helper. Age 38. Address: Box 295, The FOUNDRY, Cleveland 13, Ohio.

PATTERN SHOP FOREMAN

Well experienced in all types of patterns, new and repair work, rigging equipment for production, gating blower core box equipment, plastic work, pattern engineering and layout. Presently employed as foreman in grey iron jobbing foundry pouring 100 tons daily castings from 4 oz. to 500 pounds. Can furnish excellent references. Address: Box 296, The FOUNDRY, Cleveland 13, Ohio.

Opportunities

OPPORTUNITY

If you are contemplating relocating, you should request a copy of "Business Opportunities in Watertown, South Dakota". Call or write Mayor Gilbert or the City Promotional Director. J. G. Ihnet.

OPPORTUNITY

For the right party to buy block of stock in brass and aluminum foundry and manufacturing concern. Active participation if desired. Address: Box 293, The FOUNDRY, Cleveland 13, Ohio.

CLASSIFIED ADVERTISING

Available Capacity

AVAILABLE CAPACITY

Our foundry has open capacity to supply small and medium size gray iron castings. Send sample. Address: OREGON CASTINGS CO., RD 3, Lititz, Pa.

OPEN FOUNDRY TIME

Large capacity available for small to medium size ferrous and nonferrous castings. Production heat treating facilities.

DONEGAL MANUFACTURING CORP.
635 E. MARKET MARIETTA, PENNSYLVANIA

OPEN CAPACITY

Have open capacity for squeezer work in gray iron. ADDRESS: PHARISBURG FOUNDRY CO., MARYSVILLE, O. R.1.

AVAILABLE CAPACITY

We have open capacity for producing light to medium weight gray iron castings, squeezer, bench or floor work. Address: Badger Iron Works, 921 Broadway, Menomonie, Wisconsin.

Employment Service

SALARIED PERSONNEL

$3,000-$25,000. This reliable service, established 1927, conducts confidential negotiations for high-grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Address: JIRA THAYER JENNINGS. 241 ORANGE STREET, NEW HAVEN 10. CONN.

SALARIED POSITIONS

$3,500 to $35,000. We offer the original personal employment service (established 41 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. Address: **R. W. BIXBY, INC., 101 DUN BUILDING, BUFFALO 2, NEW YORK.**

Foundries For Sale

FOUNDRIES FOR SALE

IRON FOUNDRY. Fully equipped for quantity production of castings to 100 lbs. Capacity 25 tons daily. Very profitable. Priced to sell.

BRASS & ALUMINUM FOUNDRY. Small shop with land for expansion. Steady business.

EDWARD H. ZOLL
INDUSTRIAL PROPERTIES
THROUGHOUT THE EAST
790 BROAD ST. NEWARK, N. J.

GREY IRON FOUNDRY

Specializing in light weight castings. Milwaukee area, on railroad siding with room for expansion. Long established business, excellent accounts. Has always been a real money maker. Address: Box 277, The FOUNDRY, Cleveland 13, Ohio.

GRAY-IRON FOUNDRY

In up-state New York, now operating profitably with complete organization. $80,000 buys this going business, modernly equipped with capacity of 30 tons small castings per week on squeezers. Open shop. Address: Box 276, The FOUNDRY, Cleveland 13, Ohio.

Foundries For Sale

SMALL FOUNDRY FOR SALE

On New York Central Railroad side track in Lockport, New York. Floor space of molders approximately 11,000 square feet with exceptional dumping ground for disposal of slag and waste indefinitely at lowest expense over declivity on the land. Considerable foundry equipment thrown in for the price of assessed value of the real estate. Address: JEFFERSON UNION COMPANY, LOCKPORT, NEW YORK.

FOUNDRY FOR SALE

Gray iron foundry, modern equipped with sand-slingers, wheelabrators, core blowers, rollovers and squeezer molding machines, etc. Pouring capacity 80 tons a day, now operating. For sale or wants to merge with large cast iron casting user. Situated in Eastern New York. Address: Box 282, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

Soil pipe foundry. Will sell equipment or complete foundry. CALL 252 FOR JACK REED, REED AND SONS FOUNDRY AND IRON WORKS, COLBY, KANSAS.

FOR SALE

Combination iron, brass and aluminum foundry. Established over 25 years. Growing agricultural and small manufacturing community. $11,000. $5,00 down. Address: Box 270, The FOUNDRY, Cleveland 13, Ohio.

Wanted-To-Buy

FOUNDRY WANTED

Grey iron foundry for light bench molding, sufficient capacity for twenty molders or more. Preferably located between New York and Boston. Address: Box 279, The FOUNDRY, Cleveland 13, Ohio.

WANTED

1—Johnston & Jennings #918 jolt rollover and draw molding machine. Address: SEATTLE FOUNDRY CO., INC., 3444 13th AVENUE S.W., SEATTLE 4, WASH.

WANTED

One #2 Simpson muller screening unit and magnetic separator. State condition and price in first reply. Address: Box 978, The FOUNDRY, Cleveland 13, Ohio.

WANTED TO BUY

Soil pipe patterns, 3 in. and 4 in. Also arbors and flasks. Address: CHESANING PIPE CO., CHESANING, MICHIGAN.

MIXERS WANTED

Used Simpson Intensive Sand Mixers. State size, condition and lowest cash price or immediate acceptance. Address Box 578, The FOUNDRY, Cleveland 13, Ohio.

WANTED

#NC2 Royer sand cutter or similar. Manufacturers of any size cope and drag patterns. PRECISION PATTERN WORKS, 5269 W. GRAND AVENUE, CHICAGO 39, ILLINOIS.

WANTED

Small or medium gray iron foundry located in upper Midwest. Present management may stay if desired. Light and medium weight castings. Write complete information. Address: Box 287, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Optical pyrometer, preferably Leeds and Northrup. Address: Box 285, The FOUNDRY, Cleveland 13, Ohio.

TUMBLAST

American Wheelabrator & Equipment. Size 20" x 27" Rubber Belt. Address: Box 280, The FOUNDRY, Cleveland 13, Ohio.

WANTED TO BUY

Grey iron foundry starting business requires American tumblast, jolt squeezers, jolt rollovers, snag grinders, air compressors, sand cutters and other miscellaneous foundry equipment. Send your list to: Box 294, The FOUNDRY, Cleveland 13, Ohio.

For Sale

FOR SALE

TURBO BLOWERS (3 Phase, 60 Cycle)

cfm	Pressure	Make	Motor H.P.	Volts	Speed
15,000	20 oz.	Ing.Rand	150	440	3570
8700	20 oz.	Ing.Rand	75	220	3500
3500	40 oz.	Spencer	60	440	1800
2200	40 oz.	Spencer	40	220/440	3600
1000	32 oz.	Spencer	15	220	
900	24 oz.	Spencer	10	220/440	
225	10 oz.	Spencer	1	220/440	3600

PRESSURE BLOWERS (3 Phase, 60 Cycle)

2500	7 oz.	Sturtevant	15	220/440	1800
2400	14 oz.	Mahr	15	220/440	3480
1800	1 in.	Sturtevant	2	220/440	
1150	20 oz.	Nth.Amer.	10	220/440	3600
950	16 oz.	Nth.Amer.			
800	8 oz.	Sturtevant	7½	220/440	3600
800	24 oz.	American	10	220	3600
450	6 lbs.	A&B	30	220/440	3450
1800	1 in.	Sturtevant	2	220/440	
150	12 oz.	Nth.Amer.	1	220	3600

MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVENUE
CLEVELAND, OHIO

FOR SALE

66" American Wheelabrator Swing Table. Serial #64445. Installed 1948. Heavy duty construction. Averaged 4 hours daily two years to May 12 last. In perfect operating condition.

Osborn #147. Hand Ram, Hand Rollover, Draw Core Machine #11956A. Installed 1948. Used about 100 hours only.

Brinnell Test Machines. Heavy Duty Floor Type Tinius Olsen Machine, 40" working height. Had been used testing large size Cylinder Blocks.

Miscellaneous other Osborn Jolt Rollover Pattern Draw Machines #403, #405, #405-77, and #601.

Miscellaneous Norton Cones and Points. ⅞" x 9" Bedco Hexagon Machine Chisels.

THE MANUFACTURERS FOUNDRY COMPANY
TEL. 3-3109 WATERBURY, CONN.

FOR SALE

Tabor Abrasive Cut Off Machine—Serial #28069—Adjustable Split table. Head will rotate 180°. Designed for 16" diameter wheels 1" spindle. All electric controls available with or without 10 H.P. Louis Allis Company Motor 3500 R.P.M. 220/440 Volt—3 phase—60 cycles. Machine in new condition used less than 200 hours.

UNITED STATES GASKET CO.
CAMDEN, N.J. ATTEN: MR. A. J. McMULLEN

EQUIPMENT FOR SALE

1 type NS, 10 lbs., 10 KW, Detroit Electric Furnace, serial #1098K. Used approximately 160 kilowatthours. Address: INVESTMENT CASTING CO., 319 CHESTNUT ST., NEWARK 5, N. J.

For Sale

FOR SALE

Roots-Connersville Blower

#6349—24 cu. ft. per revolution—18" opening $900.00 fob.

Roots-Connersville Blower

#3730—33 cu. ft. per revolution—20" opening $1000.00 fob.

Pangborn—Sand Blaster Mod. 1AV11 $150.00 fob.

Pangborn—Rotoblast 4 spindle automatic table equipped with BVR-7 Pangborn abrasive separator & bucket belt elevator, 20 hp, 5 hp and 2 hp motors included. $2000.00 fob.

Worthington—Air Compressor 17 x 13, single stage, double acting, nonlubricating type (processed air), water cooled. Displacement 912 cfm, BHP required 120, Suction Press. 5#, Ga., Discharged Press. 55# Ga. Unit consists of Compressor only, no motor. $2250.00 fob.

Cranes—overhead & jib, all sizes.

Hoists—electric, hand, air—1 to 10 ton.

Air Compressors—from 1 hp up.

Foundry Equipment. Send us your inquiries.

ALLIED MATERIALS HANDLING COMPANY
4657 SPRING GROVE CINCINNATI 32, O.

FOR SALE

IMMEDIATE DELIVERY

OVERHEAD CRANES

1—150-ton CLEVELAND—70'4" span—two trolleys. Cab—3/60/440

1—10-ton CLEVELAND — 57'2" span — Cab—3/60/440

1—10-ton CLEVELAND — 70'4" span — Cab — 3/60/440

1—10-ton NILES—57'2" span—Cab—3/60/440

1—40-ton CASE—56'9" span—two trolleys—Cab —220 volts DC

1—15-ton CASE—57'4" span—Cab—220 volts DC

Write for details and prices.

IRON & STEEL PRODUCTS, INC.
13444 S. BRAINARD AVE., CHICAGO 33, ILL.
"ANYTHING CONTAINING IRON OR STEEL"

FOR SALE

4—Osborn 275-J Jolt Squeezers
4—Osborn 601 Jolt Rollover Pattern Draw
1—Herman 2000# Jolt Rollover Pattern Draw Molding Machine
1—Osborn 322-38 Molding Machine
2—Osborn #712 Pin Lift Jolt Squeezers
2—SPO Pin Lift Jolt Squeezers
1—International Jolt Rollover Pattern Draw Molding Machine
1—Osborn 243-W Jolt Rollover Pattern Draw Machine
2—International Jolt Squeezers

BOX 292
THE FOUNDRY CLEVELAND 13, OHIO

SOIL PIPE AND FITTING EQUIPMENT

Assorted patterns, arbors, pipe machine, special ladles and other equipment necessary for the manufacture of soil pipe and fittings. Address: J. F. QUEST FOUNDRY CO., 900 SOUTH 4th ST., MINNEAPOLIS 15, MINN.

For Sale

FOR SALE

1—Gardner-Denver Air Compressor with 40 HP. Motor.
1—Gardner-Denver 8 x 9 Air Compressor with 25 HP. Motor.
1—4 Ton Modern Equipment Co. Worm Gear Ladle. V-Typo Bale.
1—1500 lb. Whiting Worm Gear Ladle, V-Type Bale.
1—3000 lb. Worm Gear Ladle V-Type Bale.
2—JDP. International Jolt Strip Machines.
6—"G" Rollover Machines 20 x 8
3—SPO Jolt Strip Squeeze Molding Machines
4—Osborn J-75 Jolt Squeezers 10"
4—Tabor Jolt Squeezers 10"
3—Electric Riddles
1—Model "M" Beardsley & Piper Screenarator
1—Model "C" Beardsley & Piper Screenarator
1—Jeffrey Sand Conditioner
2—Royer Sand Conditioners
1—Sprue Cutter with 2 HP. Motor
1—#3E Demmler Core Blower
1—#193-8 Osborn Core Blower
1—North American Blower with 15 HP. Motor, 2100 C.F.M., 16 oz. pressure.
1—North American Blower with 5 HP. Motor, 320 C.F.M. 32 oz. pressure.
6—10" New—Haynes Jolt Squeezers
6—12"New—Haynes Jolt Squeezers
4—#559 Osborn Molding Machines
4—Osborn Jolt Rollover Machines, Model 243
5—Chicago Pneumatic Air Hoists
1—Osborn Molding Machine Model 342.
1—Sly Tumbling Mill 36 x 54
1—International Molding Machine HJ 16 x 6
3—Charging Buckets for #9 Cupola.

HAYNES FOUNDRY EQUIPMENT CO.
814 ADA ST. KALAMAZOO 52, MICH.

YOUR CLASSIFIED ADVERTISEMENT IN THE FOUNDRY BRINGS RESULTS!

IF YOU ARE SEEKING A CHANGE OF POSITION TO BETTER YOUR SITUATION AND ARE QUALIFIED FOR A BETTER JOB, TELL THE 35,000 READERS OF THE FOUNDRY ABOUT IT.

DON'T "HIDE YOUR LIGHT UNDER A BUSHEL"—THERE ARE TIMES WHEN A MAN SHOULD TALK ABOUT HIMSELF AND THERE ARE A LOT OF MEN QUALIFIED FOR BETTER POSITIONS WHO DO NOT KNOW HOW TO GO ABOUT IT OR WHERE TO SEEK HIGHER RESPONSIBILITIES.

YOUR CLASSIFIED ADVERTISEMENT IN THE FOUNDRY WILL BE WIDELY READ AND THE RESULTS MAY SURPRISE YOU!

IT COSTS BUT LITTLE. WHY NOT RUN AN ADVERTISEMENT ABOUT YOURSELF IN TWO OR THREE ISSUES?

WRITE
THE FOUNDRY
CLASSIFIED ADVERTISING DEPT.
PENTON BLDG., CLEVELAND 13, OHIO

FOR SALE

JOLT STRIP PATTERN DRAW
MOLDING MACHINE

Size of Table—36 x 48—16" Draw
12" Jolt Cylinder—1800 lbs. Capacity
Machine used only two years—for sale at a fraction of replacement cost.

BALCHER MACHINERY COMPANY
1884 S. COMPTON ROAD
CLEVELAND HEIGHTS 18, OHIO
TELEPHONE: FAIRMOUNT 1-1186

FOR SALE

246 ft. 18" wide x 8 ply super insulator Sahara conveyor belting 400° to 600° temperature. This is new belting for foundry equipment. Address: Box 283, The FOUNDRY, Cleveland 13, Ohio.

For Sale

FOR SALE

MOLDING MACHINES
1—International Type GR Stationary 24 x 10
1—International Type RJ Stationary 14 x 8
1—International Type G Stationary 24 x 10
1—International Type R Portable 24 x 10
1—International Type F Stationary 26 x 8
1—International Type M Portable 24 x 10
1—Osborn 74W Plain Squeeze Portable
2—Osborn 75W Plain Squeeze Portable
3—Osborn 75J Jolt Squeeze Portable
3—Federal RAPID Jolt Squeeze Portable
4—Arcade 72-28 Jolt Squeeze Stationary
2—Tabor Jolt Squeeze
2—SPO #305 Jolt Strippers
2—SPO #611B Stationary Oscillating Jolt Squeeze Strippers
1—SPO #4½ JHS Jolt Hand Strip

BLOWERS FOR CUPOLAS AND FURNACES
1—Connersville rotary 33 cu. ft. per rev. 7500 C.F.M.
1—Connersville rotary 24 cu. ft. per rev. 6200 C.F.M.
Maxon-Premix Blowers for Gas ¼ to 1 HP

METAL MELTING EQUIPMENT
1—Stationary Crucible Aluminum Furnace, gas fired, 400# Cap. complete with blower and motor
1—Hausfeld 1450-M Tilting Crucible Furnace, Multiple Burner, 400# aluminum
1—Stroman 750# brass, Tilting Crucible Furnace
1—Stationary #80 Crucible Furnace
1—Hausfeld 2000# aluminum capacity furnace, barrel type, open flame, oil fired
New 32" to 41" dia. shell cupolas made to order.

TUMBLING MILLS AND SAND BLAST
2—28 x 56" Round Exhaust Mills
1—Pangborn No. 2 GH direct pressure type sand blast barrel, motor driven. Complete unit
1—Pangborn Sand Blast Unit, including generator tank, shot cleaner, bucket elevator. Suitable for use with room

MISCELLANEOUS
2—#16 Roto-clone units complete
1—Continuous Heat Treat Furnace 57' long, 1200° F. max.
1—Lamson Endless Mold Conveyor 100' long x 16' wide, with 19 x 26" pallets, 36" on centers
2—Type M Beardsley Piper Screenarators
2—Jeffrey Sanditioners
1—Standard Core Sand Mixer, with 3 HP motor
2—Sly Economy #12 Cloth Screen Dust Collectors
1—Demmler #1 Core Blower
1—9 x 8 Ingersoll Rand Air Compressor, with motor
1—Quincy 10 HP Air Compressor. Complete Unit.
4—Heavy Duty Flexible Shaft Grinders 2 HP
Complete stock of rebuilt mill and dust exhaust blowers

CLIFTON MACHINERY COMPANY
1023 W. SIXTH ST. CINCINNATI 3, OHIO

FOR SALE

Three (3) U.S. (Johnson & Jennings) #260 jolt squeezers—
two with jolt
one without jolt
10" cylinders
15" x 21" tables
Price: Lot $400.00

VULCAN HART MFG. CO.
2006 NORTH WESTERN PARKWAY
LOUISVILLE 3, KY.

FOR SALE

Simplicity model LS 4 x 4
Semi-Portable Screening and Airating Unit #144-LSA-VM114
Purchased new 1948—good condition

BOX 271
THE FOUNDRY CLEVELAND 13, OHIO

FOR SALE

1—Osborn jolt squeeze molding machine (Stradler) No. 275 JW
1—SPO jolt squeeze molding machine #110-J
Both in good condition

COLUMBIANA FOUNDRY COMPANY
COLUMBIANA OHIO

FOR SALE

50—12" x 18" 2-pin steel flasks, 3" cope and 3# drag. A-1 condition. Address: FIELDS CORNER BRASS FOUNDRY, INC., 9 STURTEVANT STREET, DORCHESTER 22, MASS.

For Sale

FOR SALE

Pangborn type FG Blast Cleaning Barrel: with GD1-357a-8 nozzles; No. 2 DMD, serial 2GF-461; ½ HP, geared head motor V-431414 on cust BM; Size O, type 1, hand starter; set No. Fed. F2.0 heaters; 42 LE-P-151 ¾" air jet. Address: FIELDS CORNER BRASS FOUNDRY INC., 9 STURTEVANT STREET, DORCHESTER 22, MASS.

FOR SALE

Soil pipe equipment. Full line of flasks, arbors, patterns and other equipment to manufacture 4" soil pipe and fittings. Address: Box 288, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

30—Used Dump Buckets. 10 Gage Steel 18" deep 30" wide across bails. Cut out 5" on dump side. Equipped with 6 feet long ⅜ cable chain with adjustable hooks—4 wheel H.D. Ball Bearing Trolleys, 3000# capacity for 4" flange monorail.
1—5JR - 360 Rockwell Superficial Hardness Tester. New 1946. Never used.

GALE MANUFACTURING COMPANY
ALBION, MICHIGAN

FOR SALE

Spencer Blower, excellent condition, rated capacity 9000 c.f.m. at 24 oz. pressure, complete with Westinghouse type CS-Frame 663 C, 100 h.p., 1750 r.p.m., 440-volt motor and Cutler Hammer Auto transformer starter. Priced at $4500. Address: LUFKIN FOUNDRY & MACHINE CO., LUFKIN, TEXAS.

FOR SALE

1—Mahr, model No. 556-C—750,000 B.T.U. oil-fired, portable mold dryer. Brand new—never used. Attractively priced for quick sale. Address: Box 273, The FOUNDRY, Cleveland 13, Ohio.

For Sale

FOR SALE

Two Ransohoff end loading, end unloading automatic star return wet mills. Used, but in excellent condition. Size 60" x 84", with separate power loaders and sand handling equipment. Change in product enables you to buy this equipment at fraction of value. Can be inspected in Cleveland area. Address: Box 289, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

Sand cutter 79/60, American model M, serial No. M 298. All electric—220 V. A-1 condition. Address: EMPIRE PATTERN and FOUNDRY CO., BOX 1647, TULSA, OKLAHOMA.

FOR SALE

32" short stack cupola with new motor and blower. V-belt drive. Blower has self aligning ball bearing pillow blocks. Sketch and price on request. Address: Eugene Snider, Pulaski, Virginia.

SURPLUS SAND BLASTING EQUIPMENT

Pangborn BN 2 cabinet suction type $275.
Pangborn 6' rotary blast tables $800.
Pangborn 2AQ1 generator with BVR7 abrasive separator elevator $550.
Dust collectors, all sizes and makes.

M. ELSTEIN
141 MANGIN STREET
NEW YORK 2, N. Y.

FOR SALE

1—Spencer turbo compressor—5300 C.F.M. 18 oz. with 40 HP, 440 V. motors and controls.
1—G.E. Blower—3200 C.F.M. 16 oz. with 20 HP motor.
Reasonable.

WRITE: MR. WILLIAM SCHROTH,
THE J. H. DAY COMPANY, INC.,
CINCINNATI 22, OHIO

CLASSIFIED ADVERTISING

FOR SALE

1 U.S. jolt rollover pattern draw machine No. 815-B, 30" x 40" table, 15" draw. Brand new, still on factory skids. Will sell at approximate half price. Address: **BATTLE CREEK FOUNDRY CO., P.O. BOX 278, BATTLE CREEK, MICHIGAN.**

FOR SALE

1—Champion Pin Lift Molding Machine
2—Osborn Jolt, Squeeze, Rollover, Draw Molding Machine
1—Besly 53" Dia. Surface Disc Grinder
1—Kent-Owens #2 RV Milling Machine
Complete Bessemer Converter Steel Production Equipment Including Shells, Tilting Assemblies, Blower and Motor, and Controls

GUNITE FOUNDRIES CORPORATION
ROCKFORD, ILLINOIS

FOR SALE

MOLDING MACHINES
4—International 20" x 8", Type G
1—Herman, 1500 series, air clamps
4—Osborn J.R.O. #243
3—Osborn—Jolt Strip #559
8—Arcade Jolt Squeezers

CORE BLOWERS
1—Osborn #193, air draw
1—Demmler #3-E, air draw

6—Ingersoll Air Hoist, 1 & 2 ton

RAY P. SCULLY
SCULLY MACHINERY & EQUIPMENT CO., NOT INC.
767 MILWAUKEE AVE. CHICAGO 22, ILL.
PHONE: CANAL 6-0314

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POSITION WANTED — Minimum advertisement set solid, 30 words or less, $2.50. Additional words 9c each.

ALL OTHERS—"Help Wanted"—"For Sale"—"Wanted"—"Personals"—"Services", etc., minimum advertisement set solid, 30 words or less, $5.00. Additional words 15c each.

NOTE—If replies are to be sent to a box number in care of THE FOUNDRY, add 6 words to your advertisement for box number and address.

Any advertisement set in all capital letters, add 50% to the above rates.

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Single Column 2¼" Wide	One Time	Three Times	Six Times	Twelve Times
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3 inches	40.00	36.50	33.50	30.00
4 inches	50.00	46.00	41.50	37.50
5 inches	60.00	55.00	50.00	45.00
6 inches	73.50	66.50	60.00	53.50
7 inches	82.50	75.00	67.50	60.00
8 inches	91.50	83.50	75.00	66.50
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Full Page	275.00	250.00	225.00	200.00

Remittance should accompany advertisement when submitted—Cash Discount 2%, 10 days.

Classified Forms Close the 13th of Month Preceding Issue

THE FOUNDRY

Penton Building, Cleveland 13, Ohio

Manufacturers' Agents!

REGISTER NOW WITH

FOUNDRY

• If you are interested in adding to the lines of foundry equipment, accessories or supplies you are now handling, please fill out the form below, or write us fully, stating what foundry equipment you are now handling and what allied lines you can take on.

We often have calls for available representation in various parts of the country and might be able to refer you to manufacturers with whom you can make a mutually profitable arrangement.

In the near future a new and revised Foundry Supply House and Manufacturers' Representative list will be published by us for use by manufacturers seeking additional sales representation and if you are in position to offer good coverage in certain areas, tell us about it and we will not only add your name to this new list but will keep the information on special file so that we may bring your facilities to the attention of those inquiring.

FILL OUT THIS FORM AND SEND IT TO US NOW

FOUNDRY,
Atten: Jack Lathrop,
Penton Building, Cleveland 13, Ohio

Date .....

Equipment or products we are now handling .....

.....

We would be interested in handling the following lines: .....

.....

Territory we now cover regularly: .....

.....Number of salesmen we employ: .....

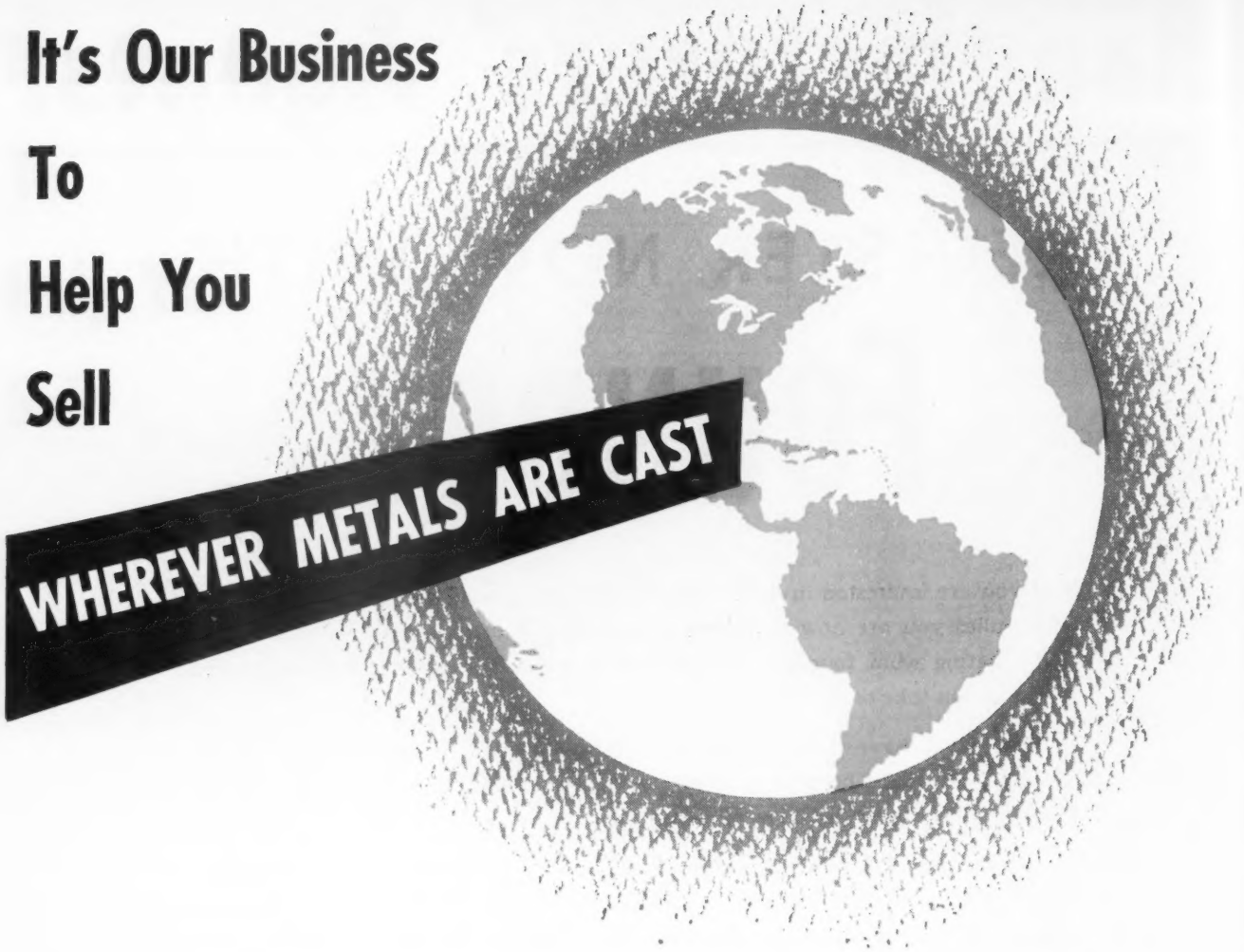
We would appreciate being included in your new list and referring us to any manufacturers of the above equipment or producers of supplies who are seeking additional representatives.

NAME: _____

ADDRESS: _____

CITY: _____ ZONE: _____ STATE: _____

It's Our Business To Help You Sell



In your selling to this $3 Billion foundry industry, you'll find a helpful partner in THE FOUNDRY.

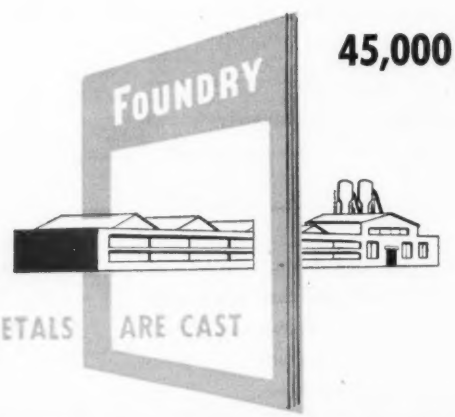
Its nineteen editors are constantly emphasizing the need for mechanization and modernization. Developments and new methods are continually reported to more than 45,000 FOUNDRY readers throughout an industry that spends money to make money.

THE FOUNDRY "knows" the foundry market. We can help you measure it by type of foundries, geographically, and by capacity. We can supply you with information that will help you establish or improve distribution in this market.

We can help you reach, with your sales messages, the foundries with over 90% of the industry's melting capacity. Tell us what you want to know about selling to foundries and we'll do our level best to help you.

45,000 READERS

Helping You Sell To Foundrymen



A PENTON PUBLICATION, PENTON BUILDING, CLEVELAND 13, OHIO

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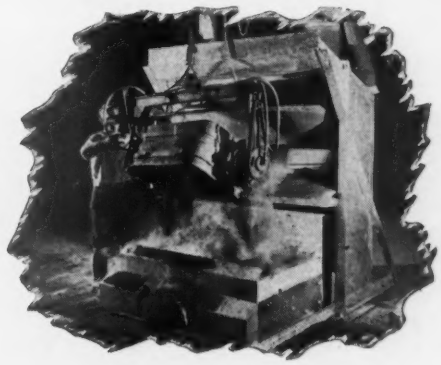
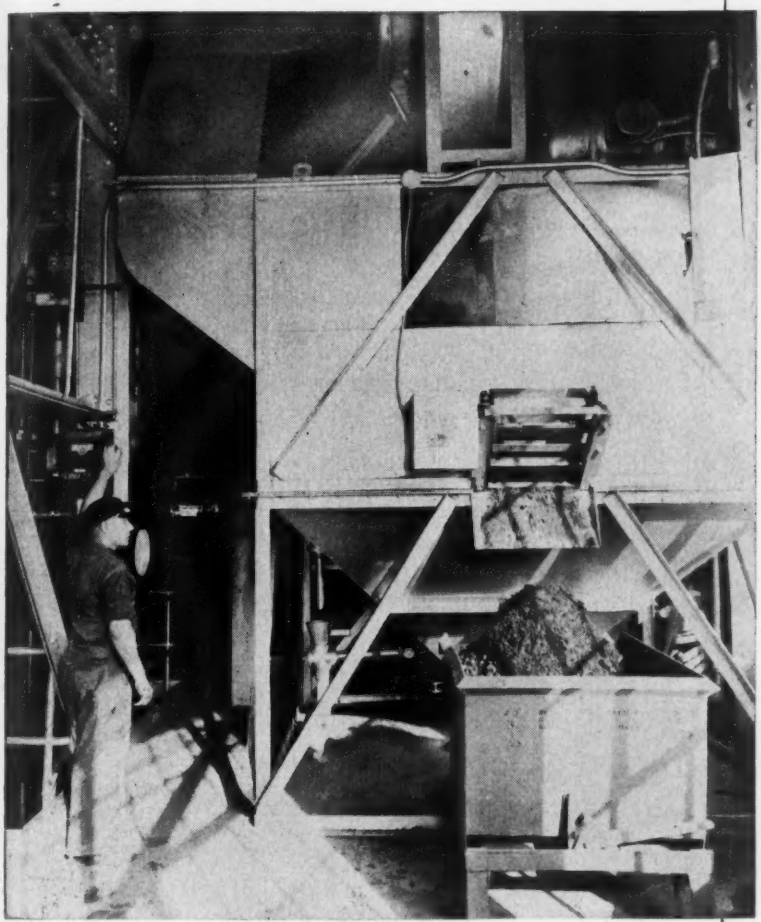
The sludge tells the story of ROTO-CLONE'S efficient dust control





• *Fine dust collected by Type W Roto-Clone from shakeout is discharged as a mud-like sludge for easy disposal*

• *Bulletin No. 274-A—gives the complete story about Type W Roto-Clone design and operation. It's free—write for a copy now!*

MINUTES ago the sludge shown at left consisted of millions of free fine dust particles of small micron size. They were released during the operation of the Link Belt 3x5 Shakeout pictured above. But before this dust could foul up the atmosphere, it was snapped up by the side-hood exhaust of a Type W Roto-Clone* (Arrangement C) and transformed into a harmless, easily disposed sludge.

The Type W Roto-Clone and AAF Shakeout Side-Hood combine all the features of complete dust control—confinement at the source, effective exhaust, high efficiency collection and discharge of consolidated sludge without creating a secondary dust problem. The Type W is a wet-type collector, combining water sprays and dynamic precipitation. Operation requires little water and no recirculating equipment.

Dust from shakeouts, sand conditioners and grinders; smoke and fumes from electric furnaces — all can be controlled effectively and economically with one of the many types of Roto-Clone equipment.

Write today for complete information or call your local AAF representative.

*Roto-Clone is the trade-mark (Reg. U.S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.

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